First published in 2008
Reprinted in 2009

TERI (The Energy and Resources Institute)
Darbari Seth Block, IHC Complex, Lodhi Road, New Delhi - 110 003, India
Tel. 2468 2100/4150 4900, Fax: 2468 2144/2468 2145
India +91 ▪ Delhi (0)11
Email: teripress@teri.res.in ▪ Website: http://bookstore.teriin.org

Adapted for UAE by Environment Agency, Abu Dhabi

ISBN 978-81-7993-142-4

Adaptation Material: Environment Agency, Abu Dhabi
Managing Editor: Madhu Singh Sirohi
Series Editor: Pallavi Sah
Art Direction and Concept: Priyabrata Roy Chowdhury
Illustration: Rajesh Das

SAVE PLANET EARTH

101 Q&A on CLIMATE change

Terrapin

Note from Mr. Majid Al Mansouri

It is He, who made you trustees of the earth,
And exalted some in rank over others.
In order to try you
By what He has given you
Indeed your Lord's retribution is swift
Yet He is forgiving and kind.

Verse from Holy Quran –Surat Al Ana'am

Ayah 165 (6:165)

Climate change today is threatening our planet and in fact our very survival on earth .All countries and governments are concerned as we humans have contributed to this malaise. To find solution to any problem, we must first fully comprehend it. Hence Environment Agency – Abu Dhabi (EAD) in association with The Energy Research Institute (TERI) is adapting and bringing this save planet series of books on Climate change to children in the UAE with a hope that students as future custodians of our environment learn about what ails our mother earth, how each one us impact the environment through our actions, so that they are in a position to make appropriate decisions on matters that affect the health of our planet.

Climate change is expected to have direct and indirect impacts on earth. Scientists predict that we would lose nearly one third of our biodiversity, Sea levels would rise flooding low lying areas, face severe fresh water shortages , desertification , health issues such increased incidences of infectious diseases, heat strokes, forest fires, hurricanes and extreme and strange weather patterns to name some .

While governments are trying to fathom this new reality and looking at ways and means to tackle this global issue, it is becoming clearer to all, that only a concerted and collaborative action from each and everyone can actually help save this unique planet. United Arab Emirate too is aware of its responsibility and that is why despite being a country which is endowed with vast reserves of petroleum, a non renewable resource, and the one which contributes to climate change, it is working hard to establish the first carbon neutral city MASDAR in the coming few years and invest more on developing the renewable source of energy in the country. In addition, the country is also aiming to educate its future generation, through imbibing sound knowledge, imparting skill and helping to develop right attitude towards the environmental issues so as to prepare them to face any eventualities in the future.

We hope these books would be read by all students and would help them to understand the issue of climate change and the role that they can play in helping to save this unique planet.

CONTENTS

1

ARE NATURAL FACTORS RESPONSIBLE FOR CLIMATE CHANGE?

Yes, climatologists have discovered that there are some natural factors that lead to climate change. One of these is the Milankovitch Cycle, which explains how the change in the earth's orbit around the sun affects the climate. The changes influence the earth's tilt towards or away from the sun. The warming of the earth is affected by the amount of solar energy that it receives, which, in turn, depends on the tilt of the earth.

2

WHY ARE GREENHOUSE GASES IMPORTANT?

Greenhouse gases, found in the atmosphere, cover the earth like a blanket. Although a high concentration of these gases is harmful for the environment, if it were not for greenhouse gases, our planet would have been about thirty-three degrees Celsius colder than it is now!

3

WHAT IS THE PERCENTAGE OF OXYGEN IN THE ATMOSPHERE?

Oxygen is essential for the life on the planet. The atmosphere contains about twenty-one per cent of the total oxygen on the earth. Can you guess how much oxygen there was on the planet at the time of its formation? Believe it or not, at that time there was no oxygen at all! It has taken millions of years for oxygen to build up in the atmosphere.

4

WHICH FOSSIL FUELS EMIT THE LARGEST QUANTITIES OF SULPHUR DIOXIDE GAS?

Coal and oil emit the largest quantities of sulphur dioxide (SO_2) gas. Both these fossil fuels contain large quantities of sulphur, which on burning releases sulphur dioxide into the air. Did you know that sixty-five per cent of the annual SO_2 emissions come from electric utilities that burn coal?

5

WHICH TWO GASES HAVE THE LARGEST SHARE IN THE POOL OF EMITTED GREENHOUSE GASES?

Of all the greenhouse gases emitted into the atmosphere, carbon dioxide (CO_2) and methane are in the largest concentration. Together, they make up nearly ninety per cent of greenhouse emissions. Of this, seventy-six per cent is CO_2 alone!

6 Which cereal crop, planted in ankle-deep water, emits large quantities of the greenhouse gas methane?

This crop is rice. Flooded rice cultivation produces methane gas by the fermentation of the organic matter in the soil. The gas is released from submerged soils through the roots and stems of rice plants. Methane is a major greenhouse gas and can lead to more rapid global warming than carbon dioxide!

7 What are CFCs?

CFCs, or chlorofluorocarbons, are chemical compounds that contain chlorine, fluorine, and carbon. These are artificially created, very strong greenhouse gases. Although these are non-polluting and safe to use, CFCs contribute very significantly to ozone depletion. CFCs are released from aerosol sprays, refrigerants, and the production of foams.

8 How do aerosols in the atmosphere affect rainfall?

Research shows that aerosols affect rainfall patterns in tropical countries. The water in the atmosphere gets deposited on the aerosol particles to form clouds. The larger the number of these particles, the greater are the tiny water droplets formed. These drops take longer to form into bigger ones that can fall as rain. Rainfall is reduced because the clouds move away to drier areas and get evaporated!

9 What is the ozone shield?

The ozone shield, which lies between ten and forty kilometres above the surface of the earth, is found in the stratosphere, a layer of the atmosphere. It protects the earth's surface by absorbing the harmful ultraviolet radiation from the sun.

10 What has been the amount of increase in the emission of greenhouse gases in the last two hundred and fifty years?

In the last quarter of a millennium there has been a massive increase in the emission of greenhouse gases into the atmosphere. The emission of nitrous oxide has risen by fifteen per cent, methane by fifty per cent, and carbon dioxide by a whopping fifty per cent!

11

WHAT IS GLOBAL WARMING?

Global warming can be described as the rise in the temperature of the earth due to excessive increase in the concentration of greenhouse gases. Global warming is also known as the greenhouse effect. If global warming continues at the current rate, by the year 2100, the temperature of the earth is expected to rise by 1.8–4 degrees Celsius!

12

WHICH IS THE MOST HARMFUL TYPE OF ULTRAVIOLET RADIATION?

The most dangerous ultraviolet radiation is the Type C ultraviolet radiation. But the good news is that this radiation is completely absorbed by the ozone layer and oxygen and does not reach the earth.

13

HOW MUCH CARBON DIOXIDE IS EMITTED INTO THE ATMOSPHERE ANNUALLY?

We know that plants absorb carbon dioxide (CO_2). All the trees and plants of the world together take in 6.1 billion metric tonnes of this greenhouse gas. Despite that, a staggering 3.2 billion metric tonnes of CO_2 is added to the atmosphere every year! A portion of it comes back from deforestation. As soon as a tree is cut, the CO_2 stored in it escapes into atmosphere.

14

WHICH POLLUTANT, EMITTED BY SUPERSONIC JETS, IS DAMAGING THE OZONE LAYER?

Supersonic jets release high quantities of pollutants. Nitric oxide is one of the major emissions from these jets. This reddish-brown, pungent smelling gas is extremely poisonous and one of the worst air pollutants. It is also leading to the depletion of ozone.

15

WHO WAS THE FIRST PERSON TO DESCRIBE THE PHENOMENON OF ACID RAIN?

Robert Angus Smith was the first person to describe the phenomenon of acid rain in 1852. He even coined the term ‘acid rain’. Working at that time at the Royal Manchester Institution in Manchester, UK, this famous analytical chemist explained the relationship between acid rain and atmospheric pollution.

16

HOW IS SULPHUR DIOXIDE GAS EMITTED INTO THE ATMOSPHERE?

Sulphur dioxide (SO_2) gas is emitted into the air largely through industrial processes such as smelting of ore and natural processes like burning of fossil fuels and processing of natural gas. Did you know that ten per cent of the total SO_2 emission is from volcanoes!

17

WHICH HARMFUL RADIATIONS ARE KEPT OUT OF THE ATMOSPHERE BY THE OZONE LAYER?

The ozone layer keeps ultraviolet rays from reaching the earth. These harmful radiations can cause skin cancer, damage the eyes, affect farming crops, and can also ruin ocean life and forests.

18

WHAT USE DID NITROUS OXIDE GAS HAVE IN THE FIELD OF DENTISTRY?

This might sound unbelievable but the poisonous nitrous oxide gas was used by dentists to numb areas in their patients' mouths. However, this practice has now been discontinued and dentists now use local anaesthesia for this purpose.

19

WHICH COMPONENT OF CHLOROFLUOROCARBONS IS RESPONSIBLE FOR THE DESTRUCTION OF THE OZONE LAYER?

Atoms of chlorine that are released by chlorofluorocarbons are primarily responsible for damaging the ozone layer. Chlorine breaks up the ozone into one molecule of oxygen gas and one loose, unstable oxygen ion, thereby destroying the ozone shield.

20

WHY IS THE GREENHOUSE EFFECT CALLED SO?

The greenhouse effect was given its name by French physicist Jean Baptiste Joseph Fourier in 1827. Fourier compared the earth's atmosphere to a closed glass vessel. He identified this with the greenhouses where plants are kept. He observed that the air around the earth filters in sunlight exactly like a glass roof and therefore, gave that name to the phenomenon!

21

WHICH IS THE HOTTEST YEAR IN RECORDED HISTORY?

The hottest year in recorded history was 2005, when the average annual global temperature shot up to 14.77 degrees Celsius! This was 0.06 degrees higher than the last record of 14.71 degrees Celsius in 1998.

22

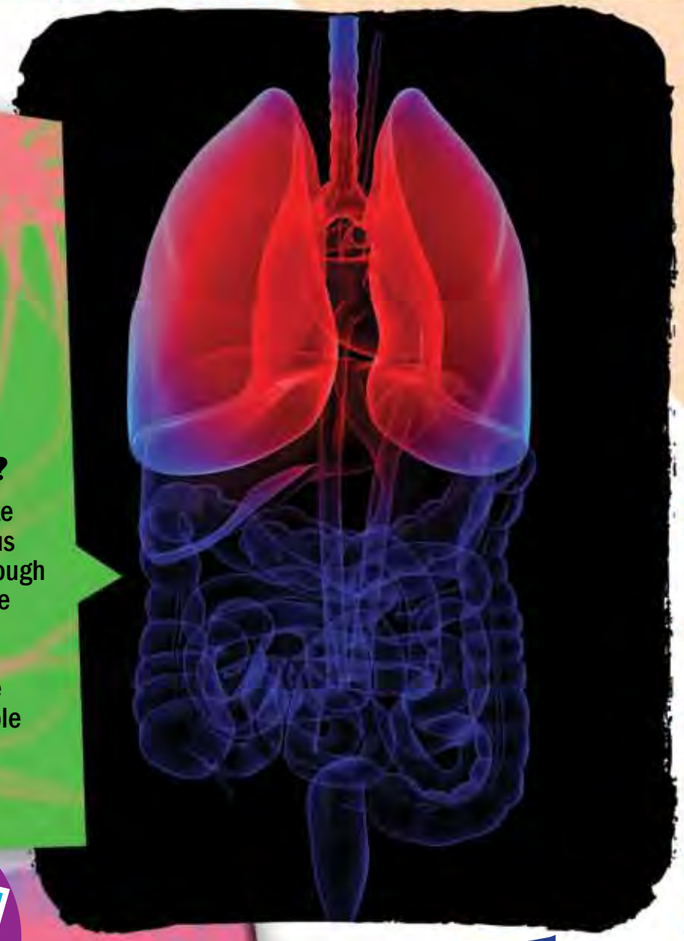
WHICH IS THE MAIN POLLUTANT EMITTED BY COAL-BASED POWER PLANTS?

Coal-based power plants, or thermal power plants, discharge a number of pollutants in the air, the main one being fly ash. India generates hundred million tonnes of fly ash each year. Nearly ninety per cent of this ends up in waste mounds. Almost forty per cent of the fly ash can be converted into cement, which could reduce energy costs and waste!

23

WHAT DOES SPM STAND FOR?

SPM stands for suspended particulate matter. It is one of the most dangerous air pollutants. It affects our lungs through the air we breathe and can even cause death. SPM is a mixture of solid and liquid particles of dust, sand, wood particles, metals, and smoke that are suspended in the air and are not visible to the naked eye.



24

WHICH INDUSTRIAL SECTOR IS THE LARGEST CONTRIBUTOR OF GREENHOUSE GASES TO THE ATMOSPHERE?

The largest amount of greenhouse gas emission – almost eighty per cent – comes from the energy sector. It is very important, therefore, that we look for alternatives, such as solar and hydel power generators, for generating power.

25

DO YOU KNOW WHY VEHICLES EMIT CARBON MONOXIDE?

Carbon is a major constituent of the fuel on which vehicles run. Vehicles emit carbon monoxide (CO) gas due to incomplete combustion, or burning of carbon in the carburettor of the engine. When there isn't enough oxygen for the carbon to burn up completely, the poisonous CO is produced and released into the air.

26

WHAT IS FLY ASH?

Fly ash is made up of very fine particles of ash that are produced when coal is burned. These are very light and rise up to mix with the air. It is a major source of air pollution. One can only imagine the damage it causes to the environment!

27

WHICH CFC IS MOST COMMONLY USED IN REFRIGERATORS?

Chlorofluorocarbons (CFCs) are hugely responsible for lowering the concentration of ozone in the atmosphere. They are widely used in many industries as well as in our homes. The CFC used most commonly in refrigerators is freon.

28

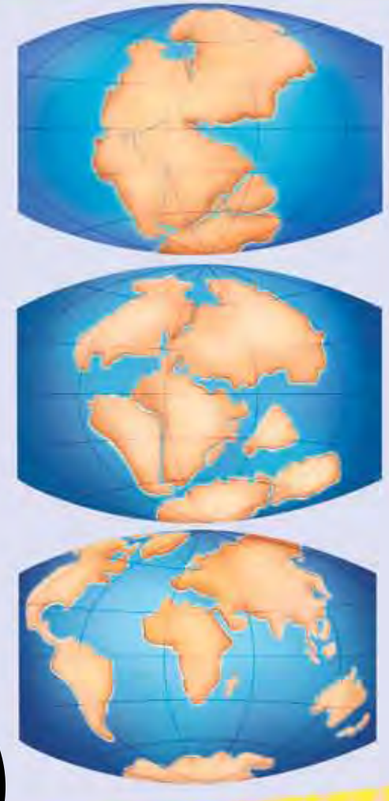
HOW DO HUMAN BEINGS CONTRIBUTE TO INCREASE IN EMISSIONS INTO THE ATMOSPHERE?

Experts believe that over half of the increase in greenhouse gases in the atmosphere was due to emissions from human sources, such as landfills, natural gas and petroleum systems, agricultural activities, coal mining, waste-water treatment, stationary and mobile combustion, and certain industrial processes. Over the last two and a half centuries, the concentration of methane in the atmosphere has increased by 143 per cent!

29

HOW DOES CONTINENTAL DRIFT LEAD TO CLIMATE CHANGE?

At the time of the formation of the earth, all the continents were merged into one solid land mass. Continental drift is the phenomenon by which the continents have very slowly drifted apart. This phenomenon leads to changes in the composition of the earth and that of mountains and oceans. Change in the flow of wind and ocean currents lead to climate change.



30

WHAT ARE AEROSOLS?

Aerosols are very tiny airborne particles suspended in the air that absorb the sun's radiations, thus causing the greenhouse effect. It may also cause a cooling effect by scattering and reflecting the solar radiation. Natural aerosols are generated from forest fires, dust storms, volcanoes, and sea spray. Ten per cent of the aerosols in the atmosphere are there as a result of human activities such as burning of fossil fuels and the use of deodorants!

31

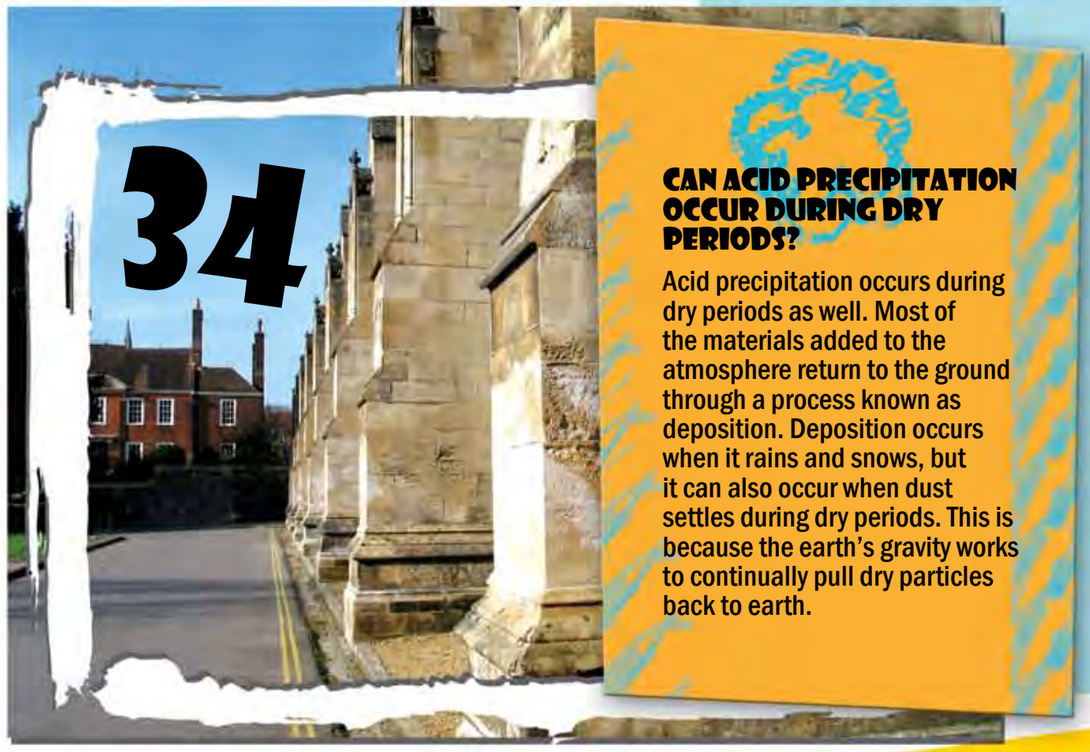
WHICH IS THE ONLY GREENHOUSE GAS PRODUCED WITHOUT ANY INTERFERENCE FROM HUMAN BEINGS?

The only greenhouse gas that is produced naturally, with no interference from humans, is water vapour! The process of evaporation from the many water bodies on the earth forms water vapour. Did you know that these tiny water droplets that rise up in the air can actually lead to ozone depletion?

32

WHAT IS BLACK LIGHT?

Ultraviolet (UV) radiation is also known as black light. Black light is used in some light bulbs, which when switched on, emit a glowing purplish light. Black light causes white objects to glow in the dark. Fluorescent ink from highlighter pens glows under black light!



34

CAN ACID PRECIPITATION OCCUR DURING DRY PERIODS?

Acid precipitation occurs during dry periods as well. Most of the materials added to the atmosphere return to the ground through a process known as deposition. Deposition occurs when it rains and snows, but it can also occur when dust settles during dry periods. This is because the earth's gravity works to continually pull dry particles back to earth.

33

WHAT IS ACID PRECIPITATION?

Acid precipitation is the term used to describe the acid pollution that can be found in the various forms of precipitation like rain, snow, hail, and fog. Acids like nitric acid and sulphuric acid are produced when pollutants nitrous oxide and sulphur dioxide react with water. These acids then come down to the earth as acid precipitation.

35

ON WHAT SCALE IS THE ACIDITY OF RAIN MEASURED?

The acidity of rain or the amount of acid present in rainwater is measured on the pH scale. The maximum acidity any substance can have is zero on the pH scale. The lesser the pH, the greater is the acidity of a substance. Rainwater with a pH below 5.6 is considered to be acid rain.

36

How does climate change affect sea levels ?

One of the most serious impacts of climate change is the rise in sea levels. The increase in global temperature has led to the melting of glaciers and ice caps, as a result of which the water level in seas has gone up. Over the last hundred years, global sea level has risen by about ten to twenty-five centimetres!

37

What is the golden pagoda?

If you thought the golden pagoda was a monument in the Far East, you guessed wrong! It is actually a flower that is native to the Western Cape, South Africa. This plant was discovered as recently as 1987, but it is already facing the threat of extinction due to the rise in temperature.

38

Why are trout and salmon in danger?

Coldwater fish trout and salmon are the most vulnerable to global warming. The ideal temperature in which these fish thrive is ten to twenty degrees Celsius. These fish cannot live in warm water, and global warming is raising th temperature of the waters that they inhabit. If the greenhouse emissions are not reduced, the numbers of these fish will drop by thirty-eight per cent by 2090.

39

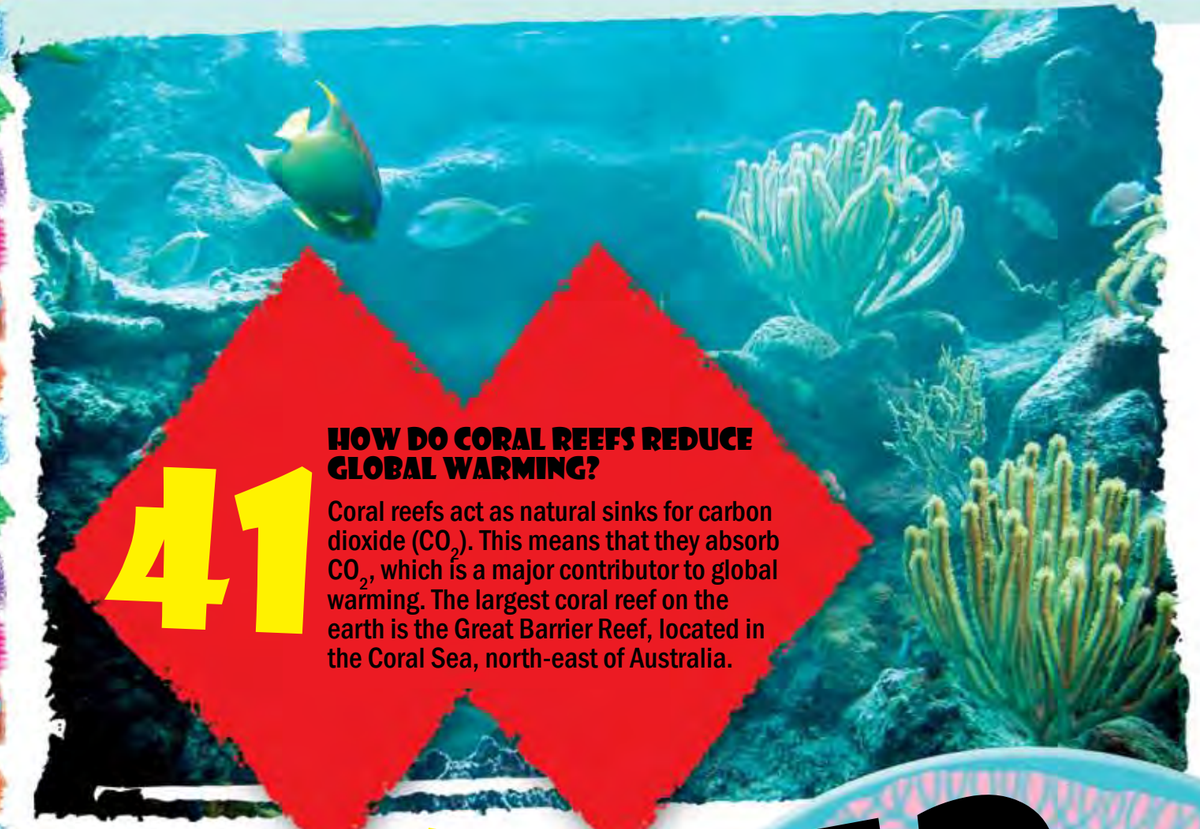
Which well-known forest in Germany has been severely affected by acid rain?

It is the Black Forest, located in south-west Germany. The Black Forest is famous for its pines and firs. It is the primary source of wood for the country's massive timber and woodwork industry. Unfortunately, the forest has been damaged due to acid rain, which has affected its flora and fauna.

40

What is coral bleaching?

Due to global warming, the temperature of oceans has also risen. When an ocean's temperature becomes much higher than what corals can withstand, the algae found there are expelled. The corals lose the green-blue colour that is imparted to them by the algae. They begin to appear as though they have been bleached white. This is known as coral bleaching.



41

HOW DO CORAL REEFS REDUCE GLOBAL WARMING?

Coral reefs act as natural sinks for carbon dioxide (CO_2). This means that they absorb CO_2, which is a major contributor to global warming. The largest coral reef on the earth is the Great Barrier Reef, located in the Coral Sea, north-east of Australia.

42

WHICH COUNTRY EMITS THE LARGEST QUANTITIES OF GREENHOUSE GASES?

The US is the largest emitter of greenhouse gases in the world. Carbon dioxide is the major greenhouse gas emitted. It constitutes about eighty-five per cent of the country's total greenhouse gas emissions! Recently, China surpassed the US as the largest emitter of these emissions per year. But if we take past emissions into account, then the US remains the biggest emitter to date.

43

DOES CHLORINE RELEASED FROM NATURAL SOURCES SUCH AS OCEANS AND VOLCANOES LEAD TO OZONE DEPLETION?

It might sound surprising, but no, it does not! A large amount of chlorine is released from natural sources such as oceans and volcanoes. However, the chlorine released through these sources is easily dissolved in water. Therefore, it mixes with the falling rain and causes no damage to the ozone layer!

44

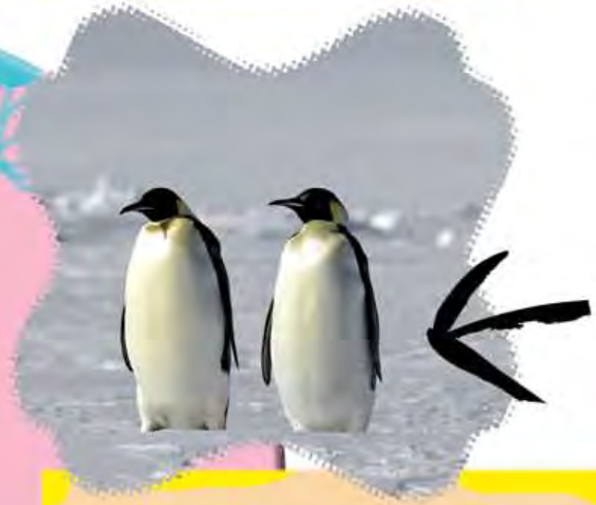
WHY IS THERE A RAPID FALL IN THE POPULATION OF FROGS AND TOADS ALL ACROSS THE WORLD?

Frogs and toads, of the amphibian class of vertebrates, are extremely sensitive to changes in climate. They cannot survive even the slightest rise in temperature than what they are used to. Many different species have died out and many are on the verge of extinction. The shiny, bright orange golden toad that once inhabited the tropical forests of South America is already extinct.

45

WHAT IS PECULIAR ABOUT EMPEROR PENGUINS?

Emperor penguins, a species threatened because of global warming, have a peculiar way of tending to their eggs. After laying their eggs in winter, instead of making nests, these birds move around carrying the eggs on their feet!



46

WHAT IS THE OZONE HOLE?

'Ozone hole' refers to a huge reduction in the amount of ozone in the stratosphere. This allows harmful ultraviolet rays to enter the earth. In September 2006, the ozone hole measured a staggering twenty-nine million square kilometres! The amount of ozone lost was about forty million tonnes.

47

What has been the rise in the temperature of the earth in the last hundred years?

Global warming has led to a significant heating up of the earth in the last hundred years, and particularly in the past few decades. The earth has become warmer by almost 0.5 degrees Celsius in the last century. The 1980s and 1990s have been the warmest decades in the last thousand years. Eight of the ten warmest years since 1860 have occurred within last decade, and the hottest years on record have all been in the last six years!

48

Why did the woolly mammoth become extinct?

The earliest woolly mammoths are believed to have walked the planet some one hundred and fifty thousand years ago! Their natural habitat was in the frozen regions of northern North America, Asia, and Europe. Woolly mammoths became extinct for two important reasons. First, they were hunted down in large numbers. Second, they were not able to adapt to the climate of the earth that was increasingly becoming warm!

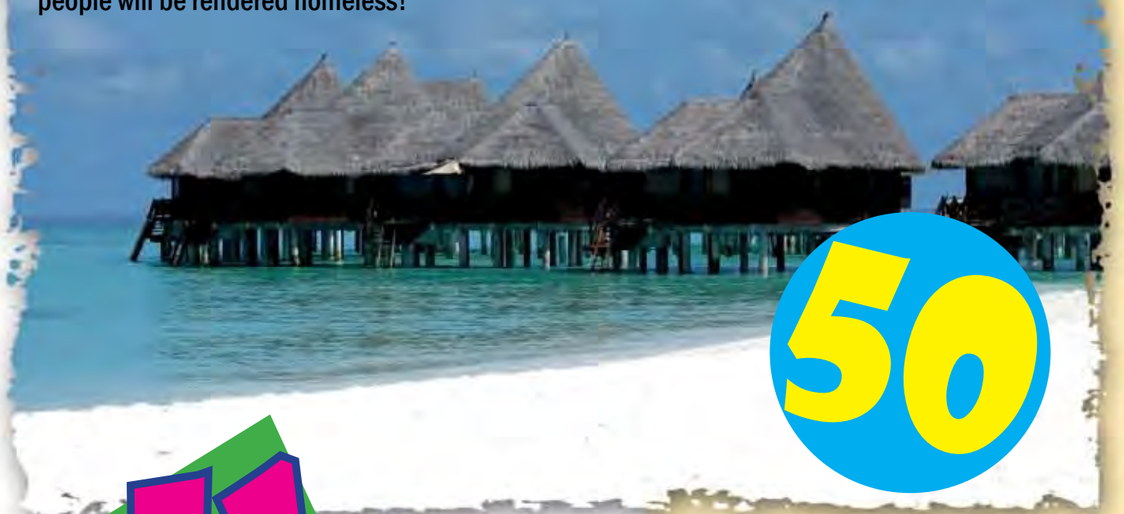
49

Over which continent is the ozone hole found?

The ozone hole occurs over the continent of Antarctica. Unlike ozone depletion, which is a global phenomenon, the ozone hole is located only over this icy continent. The ozone hole was discovered in the year 1985.

How will global warming impact the people of Maldives?

If global warming leads to an increase in the sea level of the Indian Ocean, the people of the islands of Maldives will be faced with a terrible crisis. Maldives is made up of one thousand, one hundred, and ninety islands that are located at an average height of just one-and-a-half metres above sea level. If the sea level rises, their homes will get submerged and more than two hundred thousand people will be rendered homeless!



50

51

How has the rise in temperature affected human habitat?

The rise in temperature has led to a change in the duration of seasons—winter is shorter, while summer is longer. Droughts have become more frequent and a rise in sea level is submerging islands and low-lying coastal areas. Heatwaves too occur more frequently in places they were unheard of. For instance, Chicago, which is called the Windy City because of the cold breeze that used to blow in from Lake Michigan, suffered a heatwave in 1995 that led to over five hundred deaths!

52

Which city has the dubious distinction of recording the worst nuclear power plant accident?

This is the city of Chernobyl in Russia. The accident, in 1986, was caused by a flawed reactor design that was operated by inadequately trained people and without proper safety measures. Radioactive emissions were released into the atmosphere by the steam explosion and fire. By 2004, about fifty-six people had died due to radiation, thermal burns, and thyroid cancer due to this accident.

53

WHAT ILL EFFECTS CAN GLOBAL WARMING HAVE ON THE HEALTH AND WELL-BEING OF HUMAN BEINGS?

Due to rising global temperatures human beings face a huge risk to their health and life. There is increased danger of suffering because of heatwaves and infectious diseases. Failing crops can lead to food crises. With an increase of every one degree Celsius in temperature above the optimum level, the yield of crops like wheat, rice, and corn drops by ten per cent. The spread of diseases such as malaria and dengue will also increase.

WHY IS ACID RAIN MORE OF A PROBLEM IN PLACES SUCH AS EASTERN CANADA?

Many water and soil systems in certain areas such as eastern Canada are unable to naturally neutralize the acid component of acid rain. These areas are largely made of hard granite that is deficient in alkalinity, which is essential to counter the acid. This is why regions like Ontario, New Brunswick, and Nova Scotia are severely affected by acid rain.

54

55

WHAT WAS THE ACHIEVEMENT OF THE NIMBUS-7 SATELLITE?

The Nimbus-7 satellite was launched into space in 1978 to observe the polar regions. The satellite's most spectacular achievement came in 1984–85, when it detected the ozone hole in the atmosphere! This was the first time the ozone hole and the concentration of other gases in the atmosphere were measured.

56

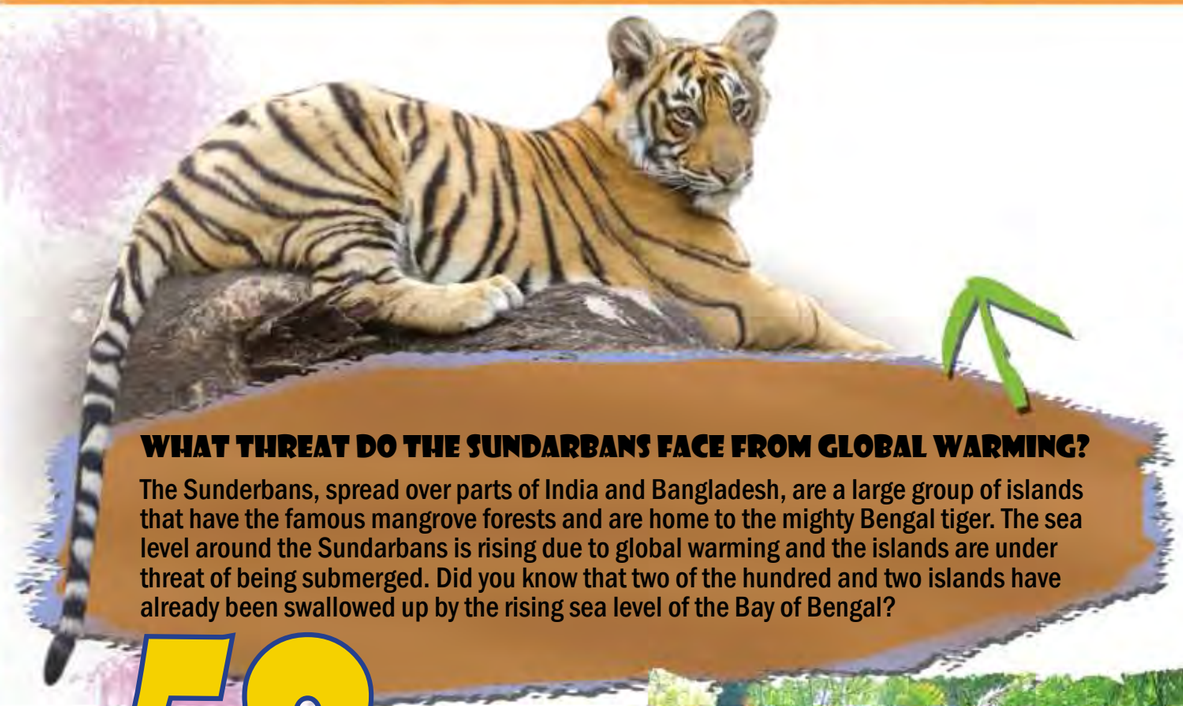
WHICH ANIMALS RELEASE THE GREENHOUSE GAS METHANE?

Farm animals such as cows, sheep, and goats as well as other cud-chewing animals like camels release methane. The bacteria in the stomachs of these animals decompose the food and convert a part of it to methane. Methane is released from their bodies when they belch! Did you know that termites also let out methane? These tiny creatures let loose five per cent of the total methane emissions into the atmosphere!

57

WHAT WAS THE RELATION BETWEEN GLOBAL WARMING AND HURRICANE KATRINA?

Simply put, Hurricane Katrina was a result of rising global temperatures. Hurricanes are caused by a rise in the surface temperatures of oceans. Katrina was the most devastating of the several hurricanes that rocked the Atlantic in 2005, killing more than one thousand people. The US suffered damages worth seventy-five billion dollars, making Katrina the most expensive natural disaster in American history.



58

WHAT THREAT DO THE SUNDARBANS FACE FROM GLOBAL WARMING?

The Sunderbans, spread over parts of India and Bangladesh, are a large group of islands that have the famous mangrove forests and are home to the mighty Bengal tiger. The sea level around the Sundarbans is rising due to global warming and the islands are under threat of being submerged. Did you know that two of the hundred and two islands have already been swallowed up by the rising sea level of the Bay of Bengal?

59

HOW DO FORESTS AND OCEANS HELP IN CONTROLLING GLOBAL WARMING?

Identified as 'natural sinks', growing forests and oceans can take in greenhouse gases and clean the air in our environment. It is believed that oceans have already absorbed eighty per cent of the heat added to the climate till now.

60

WHICH ANIMAL IN THE NORTH AMERICAN TUNDRA REGION IS UNDER THE GREATEST THREAT FROM CLIMATE CHANGE?

The caribou, living in the North American tundra region, is the most threatened by climate change. Its original home is Canada's western Arctic Islands. The caribou cannot withstand the rising temperatures. According to a report, the numbers of caribou have dropped by ninety-five per cent in just sixteen years!

61

HOW IS CLIMATE CHANGE AFFECTING THE ARCTIC SHELVES, CLOSE TO THE NORTH POLE?

Due to the rise in global temperature, ice caps are drifting away from the North Pole and several hundred miles of ice cover have already turned to water. According to one research, summer ice could disappear completely by 2100! This would wreak havoc on people who live in that area and drive animals like the polar bears towards extinction.

62

WHICH ICE-CAPPED ISLAND WILL MELT IN THE NEXT HUNDRED YEARS?

Scientists have calculated that the island of Greenland, near the Arctic Circle, will melt in the next hundred years due to global warming. Greenland is the largest non-continental ice-capped island in the world. Scientists believe that as it melts, the sea-level will rise by about half a metre.

63

What happens when CFCs are exposed to ultraviolet radiations?

When chlorofluorocarbons (CFCs) come in contact with ultraviolet radiations in the stratosphere, chlorine gas is released. Chlorine converts the ozone into oxygen, thereby destroying the ozone layer. One chlorine atom can destroy up to ten thousand ozone molecules!

64

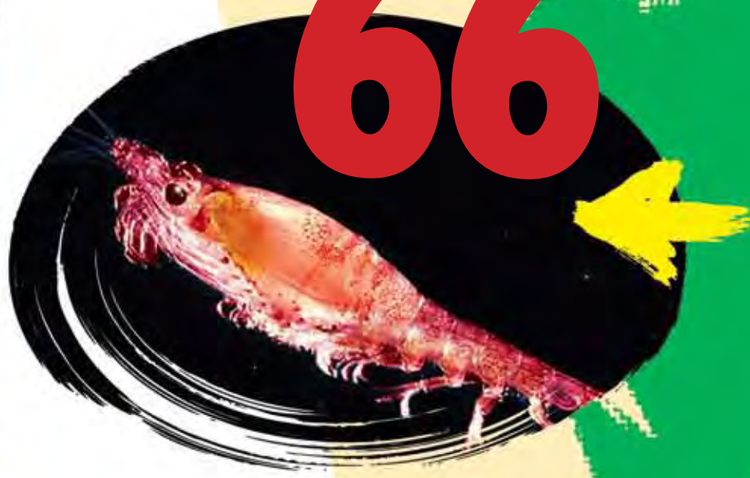
What crisis are the polar bears facing?

The polar bears are drowning! These white, furry animals that inhabit the Arctic look for food in the ice shelves. Due to rising global temperatures, these ice shelves are melting and polar bears now have to swim very long distances to find their food. The bears get exhausted and ultimately drown.

65

How does acid rain lead to global warming and climate change?

Acid rain causes severe damage to trees and forests. Trees take in carbon dioxide (CO_2) and give out oxygen (O_2). If trees are depleted, then they are unable to perform this function of converting CO_2 into O_2 efficiently enough. As a result, the concentration of CO_2 in the atmosphere goes up. This leads to increased absorption of heat from the sun, which leads to global warming.



66

How are krill in the Antarctic affected by climate change?

Krill live in cracks in the ocean ice sheets. These small creatures are of big importance to life in the Southern Ocean. They are food for whales, seals, fish, and penguins. Antarctic Peninsula, a key breeding ground for the krill, has warmed by two-and-a-half degrees Celsius in the last fifty years. This warming, along with the industrial fishing of krill, has led to a decline in the creature's population.

67

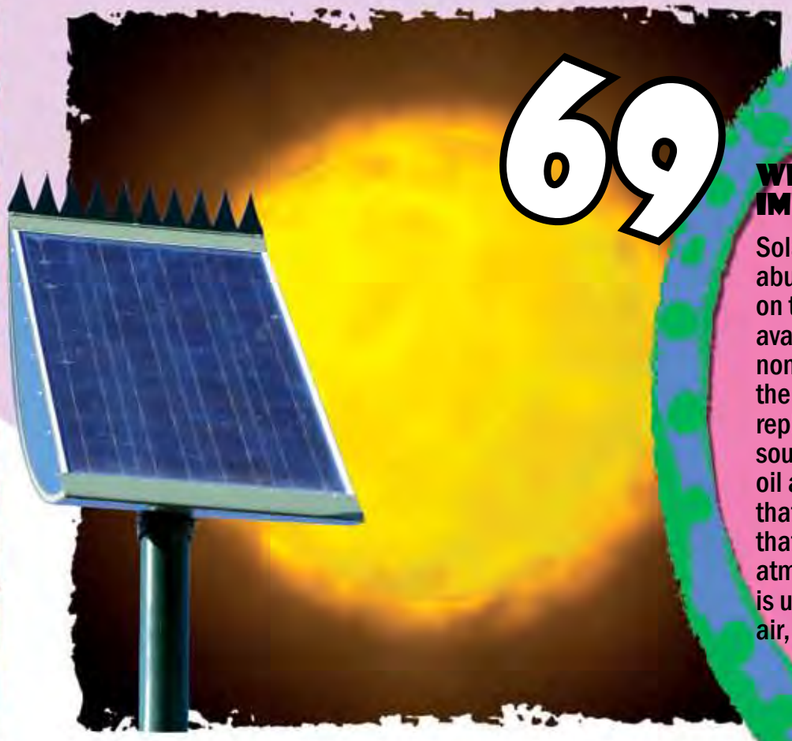
Which ocean occurrence is known as 'Little Boy'?

El Niño – a phenomenon which occurs in the Pacific Ocean – in English translates to 'little boy'. The normal high temperature area of the central Pacific gets extended up to coastal Peru in a typical El Niño episode. Trade winds blowing across the Pacific slow down and warm water accumulates at the ocean surface. The result is a change in weather patterns that lead to storms, floods, droughts, and forest fires in different parts of the world.

68

For which gas do forests act as natural sinks?

Forests act as natural sinks for carbon dioxide (CO_2). CO_2 emissions have been growing at a rapid pace over the past century. This is mainly due to the increasing consumption of fossil fuels. Apart from preventing the depletion of forests, a switch to eco-friendly fuels is a good way to reduce the concentration of this gas.



69

WHY IS SOLAR ENERGY IMPORTANT?

Solar energy is the most abundant source of energy on the earth. It is readily available, renewable, and non-polluting. It helps reduce the greenhouse effect by replacing conventional sources of energy such as oil and coal. Did you know that of the total solar energy that reaches the earth's atmosphere, seventy per cent is used up for warming up the air, land, and water!

70

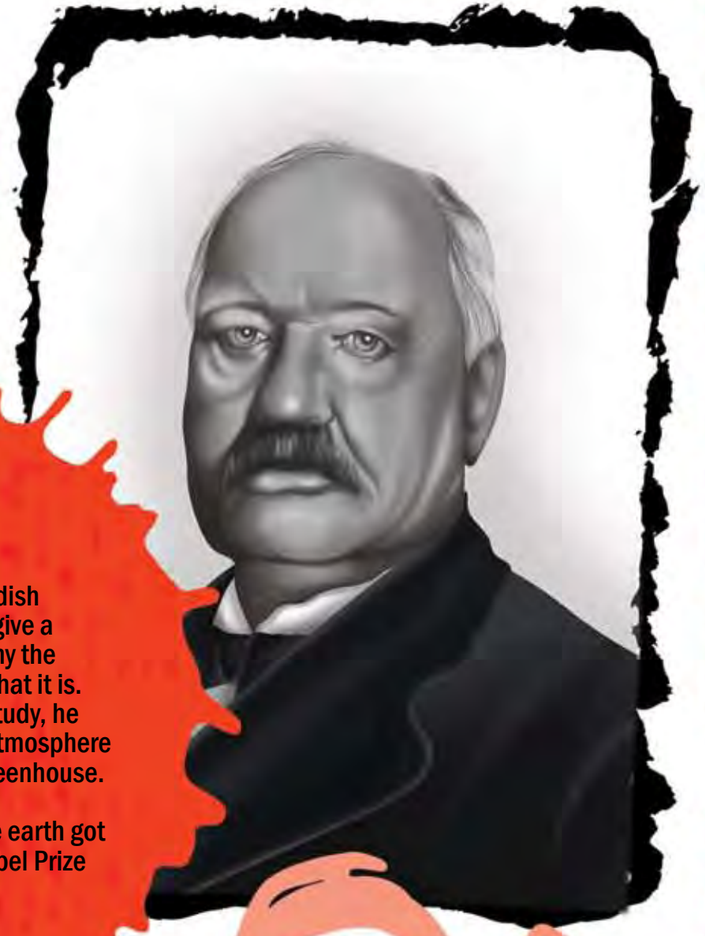
WHAT ARE WIND FARMS?

Wind farms are areas where a large number of windmills are used to generate pollution-free electricity. Holland is famous for its windmills, and the De Noord windmill in Shiedam, Holland, is the tallest windmill in the world. The blades of its fans go up to a height of forty-four-and-a-half metres.

71

WHO WAS SVANTE ARRHENIUS?

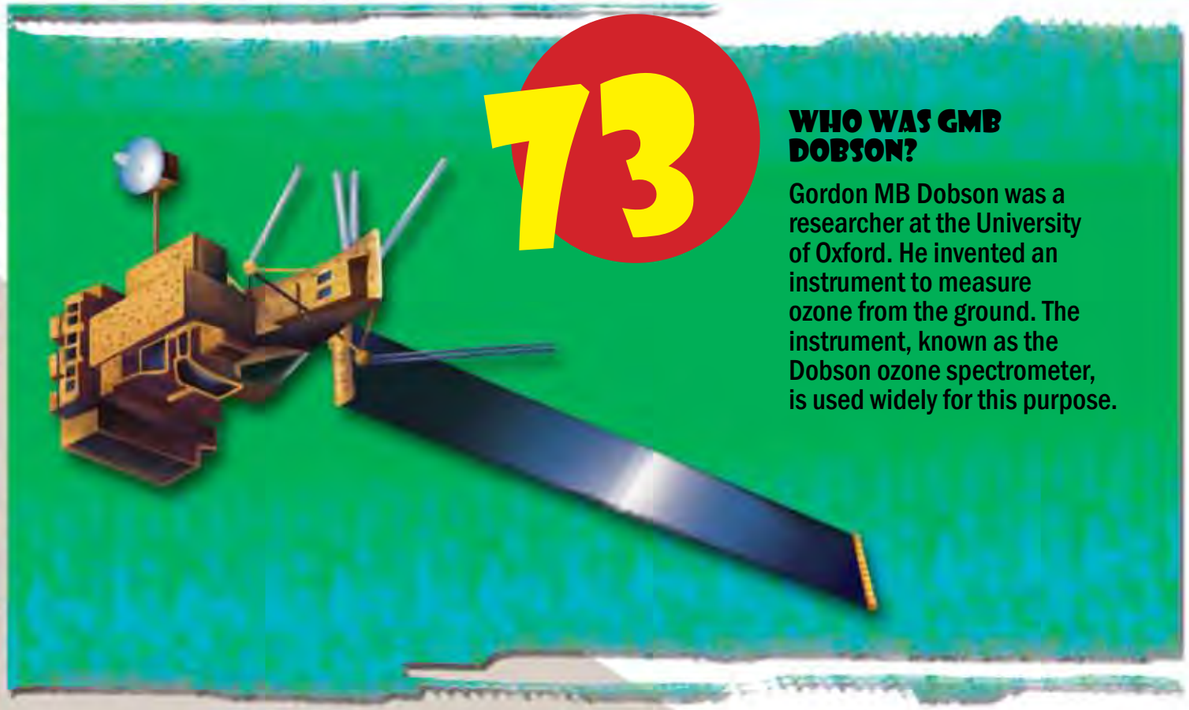
Svante Arrhenius was a Swedish chemist. He was the first to give a written explanation about why the earth is at the temperature that it is. Through his path-breaking study, he suggested that the earth's atmosphere should be thought of as a greenhouse. If we did so, it would help us understand why and how the earth got warm. Arrhenius won the Nobel Prize for chemistry in 1903.



72

WHICH PROTOCOL HAS BEEN DESCRIBED AS 'PERHAPS THE SINGLE MOST SUCCESSFUL INTERNATIONAL AGREEMENT TO DATE...'?

This international agreement is the Montreal Protocol. It is an international agreement signed in 1987 that is designed to reduce the emission of chlorofluorocarbons and protect the ozone layer. Several countries came together to pledge their support to this agreement.



73

WHO WAS GMB DOBSON?

Gordon MB Dobson was a researcher at the University of Oxford. He invented an instrument to measure ozone from the ground. The instrument, known as the Dobson ozone spectrometer, is used widely for this purpose.

74

WHAT IS EMISSIONS TRADING?

Emissions trading refers to a strategy of pollution control adopted by developed countries. These countries collaborate to lessen greenhouse emissions. A strict emission limit is set for all countries, and all groups that emit greenhouse gases are given credits (something like points), which they cannot exceed. Those that exceed the limit may buy credits from countries that have less emission. This way, developed countries are encouraged to lower their emissions, while developing countries that have lower emissions can earn money by trading their credits!

75

WHY IS CNG CONSIDERED TO BE AN ENVIRONMENT-FRIENDLY FUEL?

CNG, or compressed natural gas, is considered environment friendly. This means that in comparison to other fuels, it causes lesser damage to the environment. It is so because CNG-run vehicles emit the least amount of toxic gases. Moreover, CNG causes lesser wear and tear of the engine, thereby also increasing the vehicle's life.

76

HOW ARE HYBRID CARS USEFUL?

Plug-in electric cars produce almost half the emissions as compared to conventional combustible engines. They also use less fuel. The idea of combining combustion with an electric engine is rather old—in fact, it is over a hundred years old, invented by Professor Ferdinand Porsche.

77

WHAT ARE CYCLONES, HURRICANES AND TYPHOONS?

These natural occurances may have different names but hurricanes, cyclones and typhoons mean the same thing. Each of these is a huge collection of thunderstorms caught in a spiralling mass of air. They can travel over vast areas of water and land, causing widespread destruction. Over the last decade the world has seen a rise in these phenomena due to global warming. With growing temperatures, the sea levels are are increasing giving rise to stronger and more dangerous storms.

78

WHAT IS THE KYOTO PROTOCOL?

The Kyoto Protocol is an international agreement that makes nations responsible for reducing their greenhouse emissions. The protocol has been signed by 176 countries. It prescribes targets for these countries to limit or reduce their greenhouse gas emissions. The protocol was adopted in Kyoto, Japan, on December 11, 1997, and it came into force on February 16, 2005, after Russia signed it. UAE acceded to it in January, 2005.

79

WHAT IS THE RELATION BETWEEN THE KYOTO PROTOCOL AND THE YEAR 2012?

The Kyoto Protocol has set a deadline of 2012 as the year by which industrialized countries such as the US and the UK have to reduce the emission of greenhouse gases in their own countries by 5.2 per cent of the level they had in 1990.

80

WHAT ARE AIR TRAVEL EMISSIONS?

Did you know that for every hundred kilometres that you fly, twenty-two kilograms of greenhouse gases (GHGs) are added to the atmosphere? Just one trip between UAE and the UK would release more than one tonne or one thousand kilograms of CO_2. To travel a thousand kilometres by train would produce about hundred and fifty kilograms of carbon dioxide, whereas flying the same distance would emit two hundred and fifty kilograms of the gas.

81

UNDER WHICH AGREEMENT ARE HALONS AND CARBON TETRACHLORIDE REGULATED?

Halons and carbon tetrachloride are the two other ozone-depleting chemicals, apart from chlorofluorocarbons (CFCs), that the Montreal Protocol specifies should be phased out by 2012. These are as harmful to the ozone layer as CFCs. The earlier we are able to reduce their concentration in the atmosphere, the better it will be for the environment.

82

WHAT IS CDM?

Clean development mechanism (CDM) is a system decided upon by the Kyoto Protocol of 1997. Under it, industrialized countries like the US may invest in greenhouse emission-reducing projects in developing countries, instead of reducing emissions in their own countries that is far more expensive.

83

WHERE WAS THE FIRST HYDEL ENERGY PLANT SET UP?

Hydel energy is the energy from falling water. It is one of the best, cheapest, and cleanest sources of energy. It is renewable and, therefore, good for the environment. On September 30, 1882, the world's first hydroelectric power plant began operation on the Fox River in Appleton, Wisconsin, USA. The plant, later named the Appleton Edison Light Company, was initiated by Appleton paper manufacturer HF Rogers, who had been inspired by Thomas Edison's plans for an electricity-producing station in New York.

84

WHAT IS THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE?

The United Nations Framework Convention on Climate Change (UNFCCC) was introduced in June 1992. It was signed by 154 countries that came forward to work together to find solutions to climate change. All the countries pledged that they would consciously work towards reducing greenhouse emissions to help protect the environment.

85

WHAT IS THE GEF?

The GEF, or Global Environment Facility, was set up in 1991 jointly by the World Bank, the United Nations Environment Programme (UNEP), and the United Nations Development Programme (UNDP). It aimed to address environmental issues like global warming, international waters, and biodiversity. Its first assembly was held in New Delhi in 1998.

86

WHAT WAS THE GREAT LONDON SMOG?

The Great London Smog was a formation of heavy smog over Britain and neighbouring areas, which occurred in 1952 and left about four thousand people dead! Households that earlier used wood had begun using coal for heating and cooking. Industries already used coal. Due to the burning of all the coal, the emissions of smoke and sulphur dioxide got trapped in the fog and settled over the city, blocking sunlight and causing breathing problems.

87

WILL GLOBAL WARMING RESULT IN MORE FLOODS?

Due to global warming, glaciers and various ice bodies across the world are melting fast. Some of these could disappear as early as 2035. As they melt, there could be devastating floods. Hundreds of glaciers on the Antarctic Peninsula are flowing faster, adding to the sea levels. Climate warming is also causing an increased summer snow melt. Scientists tracking the flow rate of over 300 previously unstudied glaciers found a 12 per cent increase in glacier speed from 1993 to 2003. Countries like the Maldives and Bangladesh are under great risk of being submerged completely.

88

WHICH RENEWABLE SOURCE OF ENERGY IS FOUND BELOW THE SURFACE OF THE EARTH?

Found below the surface of the earth – in hot rocks, geysers, and volcanoes – is a treasure called geothermal energy. The use of this non-polluting source of energy can help in reducing environmental pollution and the greenhouse effect, which causes ozone depletion.

89

WHAT IS THE UNIT FOR MEASURING OZONE?

Ozone is measured in Dobson units (DU). A Dobson unit is the physical thickness of the ozone layer if it were brought to the earth's surface. It is estimated that if three hundred DU of ozone were brought down to the earth's surface at zero degree Celsius, it would occupy a three-millimetre thick layer! One can determine geographically whether an area is part of the ozone hole if the total ozone amount in that area is less than two hundred and twenty Dobson units.

90

WHAT EFFECT IS GLOBAL WARMING HAVING OVER FRESHWATER BODIES ?

Rising temperatures are going to have a huge impact on the freshwater bodies across the world. For example, Lake Baikal, the world's largest lake, located in frigid Siberia, is gradually warming up. The lake contains 20 per cent of the world's fresh water and has about 2500 plant and animal species, with most, including the freshwater seal, found nowhere else in the world. Along with the lake, these plants and creatures also run the risk of being wiped out!

91

WHAT IS COP?

COP, or the Conference of the Parties, is a part of the United Nations Framework Convention on Climate Change. It refers to the annual meetings held between countries that have signed the UNFCCC.These are held in different parts of the world since 1995, when it was held in Berlin. Similarly countries that have ratified the Kyoto Protocol participate in what is known as the MOP (Meeting of the Parties to the Kyoto Protocol).

92

WHAT IS THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE?

The Intergovernmental Panel on Climate Change (IPCC) is the world's leading organization on global warming. Set up in 1988, the IPCC is a scientific body that assesses scientific, technical, and socio-economic information necessary for understanding climate change. It looks at the potential impacts of climate change and searches for solutions. Its work against climate change, under the chairmanship of Dr R K Pachauri, won it the Nobel Peace Prize in 2007.

93

WHAT IS THE GWP SCALE?

GWP stands for global warming potential. It is a scale for measuring emissions from vehicles. The GWP was proposed by the US in 1997 during the Kyoto Protocol meeting. By using the GWP, we know that the potential of methane to cause global warming is twenty-one times that of carbon dioxide!

94

WHAT ARE THE ADVANTAGES OF USING HYDROGEN TO GENERATE ELECTRIC POWER?

Hydrogen is used in fuel cells to generate electric power quietly and efficiently, without causing any pollution. With low emissions fuel cells are now regarded as a clean alternative to disel generators and help in combating global warming. The world's largest hydrogen power plant at a cost of US$15 billion is going to be build at Abu Dhabi.

95

WHEN IS THE INTERNATIONAL DAY FOR THE PRESERVATION OF THE OZONE LAYER CELEBRATED?

In 1995, the United Nations declared September 16 as the International Day for the Preservation of the Ozone Layer. Since then, the day has been celebrated as such.

96

CAN THE DAMAGE TO THE OZONE LAYER BE RECOVERED?

The answer to this question is a bit tricky. Although the lost ozone layer cannot be reconstructed artificially, if the emissions of chlorofluorocarbons and other pollutants are checked in time, the layer can be recovered naturally. Scientists predict that this may be possible by about 2065 in Antarctica.

97

CAN THE SUN CAUSE SKIN CANCER?

Yes, indeed. Harmful ultraviolet (UV-B) radiations of the sun are a major cause of skin cancer. Skin cancer may be prevented by avoiding too much exposure to the sun and by using a good sunscreen lotion every time we step out in the sun.

98

WHICH AUTOMOBILE MANUFACTURER WAS AWARDED FOR PRODUCING CARS THAT EMIT LOW POLLUTION?

The automaker was Toyota, and it received the first ever UN Environment Protocol Global 500 award in 1999. For many years now, Toyota has focused on protecting and improving the environment. The United Nations Environment Programme granted this award to Toyota for its commitment to environmental concerns.

99

WHY IS SYNTHESIZED HFC IMPORTANT?

Synthesized hydrofluorocarbon (HFC) is a kind of fluorocarbon that can be used in place of the cholorofluorocarbons (CFCs). It is a man-made gas. As compared to CFCs, synthesized HFC is less dangerous because it causes lesser damage to the ozone layer.

100

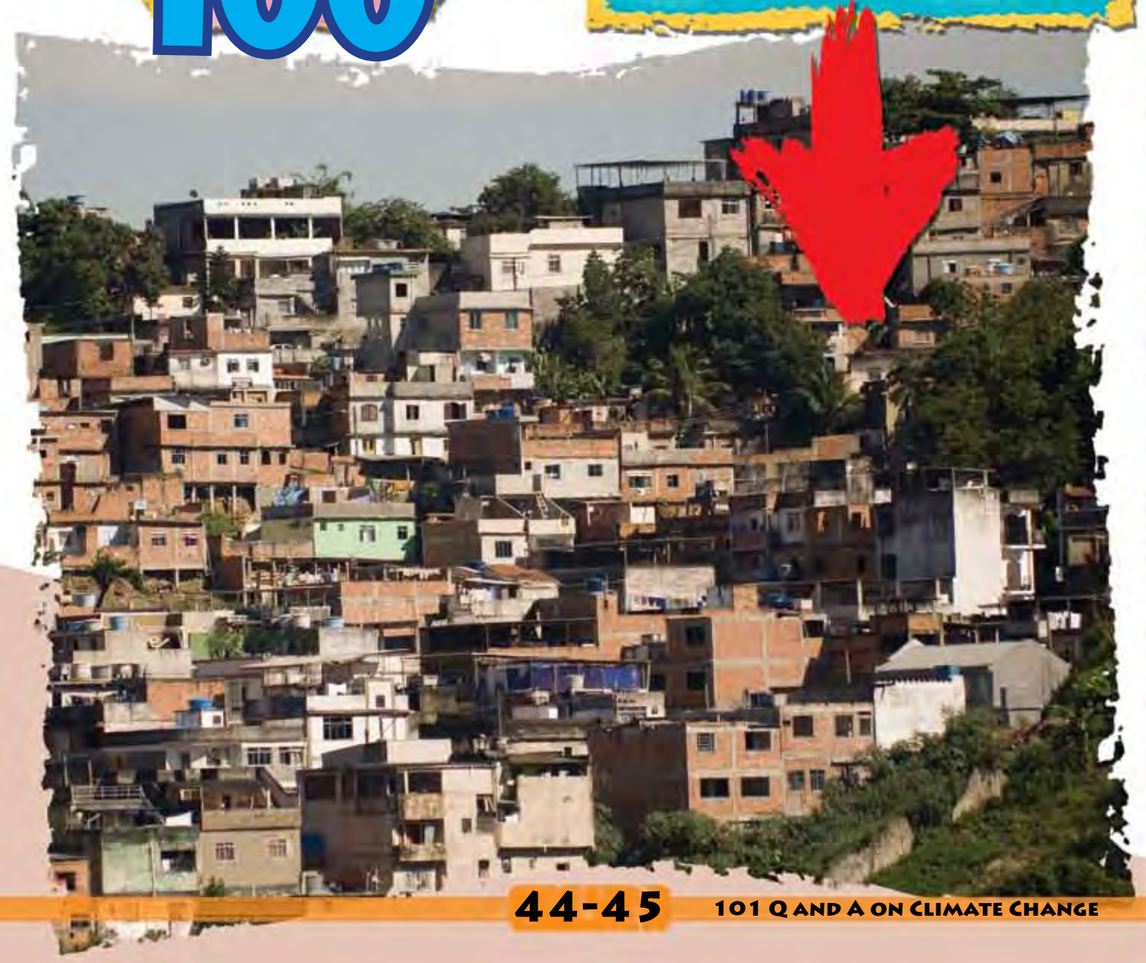
WHICH FUEL IS CONSIDERED CLEAN BECAUSE IT IS FREE OF MAJOR AIR-POLLUTING EMISSIONS?

This fuel is natural gas, which is environment friendly and cheaply available. Its main constituent is methane. It is free of carbon monoxide, nitrogen oxide, and soot, which are emitted when other fossil fuels are burned. Natural gas is found in coal beds, oilfields, and natural gas fields.

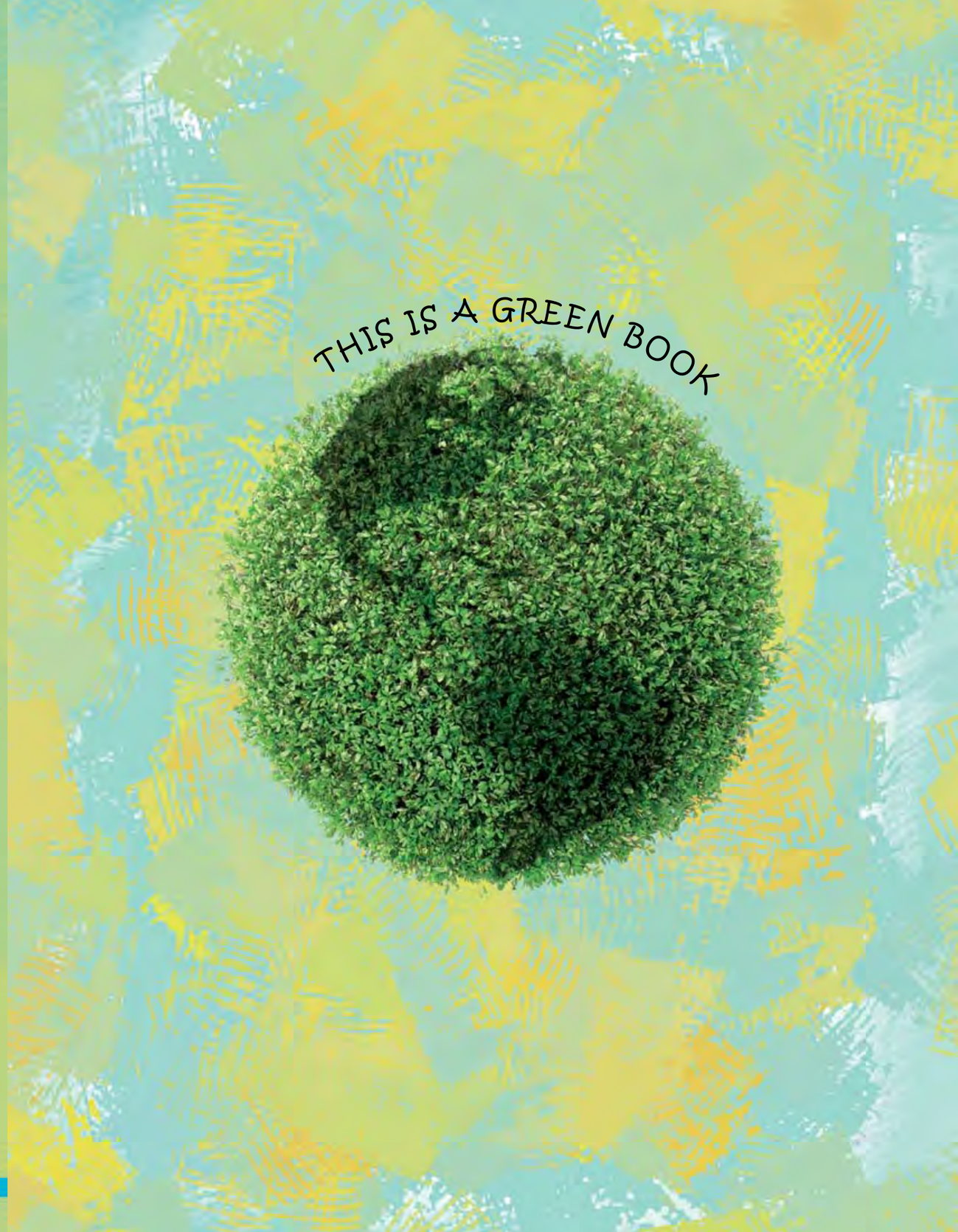
101

WHAT WAS THE EARTH SUMMIT?

The Earth Summit was a conference that addressed issues related environment, energy, and development on a global scale. It was held at Rio de Janeiro, Brazil, in 1992. One hundred and seventy governments from across the world and two thousand four hundred representatives of non-governmental organizations participated in the summit! In 2007, the Rio+15 was organized to mark the fifteenth anniversary of the Earth Summit.



INDEX



First published in 2008
Reprinted in 2009

TERI (The Energy and Resources Institute)
Darbari Seth Block, IHC Complex, Lodhi Road, New Delhi - 110 003, India
Tel. 2468 2100/4150 4900, Fax: 2468 2144/2468 2145
India +91 ▪ Delhi (0)11
Email: teripress@teri.res.in ▪ Website: http://bookstore.teriin.org

Adapted for UAE by Environment Agency, Abu Dhabi

ISBN 978-81-7993-141-7

Adaptation Material: Environment Agency, Abu Dhabi
Managing Editor: Madhu Singh Sirohi
Series Editor: Pallavi Sah
Art Direction and Concept: Priyabrata Roy Chowdhury
Illustration: Man Mohan, Rajesh Das, and Yatindra Kumar

PICTURE CREDITS
32–33 White-tailed eagle: Leirdal; 38–39 Grey-faced sengi: Sharon Murphy

Printed and bound in India

SAVE PLANET EARTH

MISSION: CONSERVATION

Author
Tanya Luther Agarwal

Terrapin

Note from Mr. Majid Al Mansouri

It is He, who made you trustees of the earth,
And exalted some in rank over others.
In order to try you
By what He has given you
Indeed your Lord's retribution is swift
Yet He is forgiving and kind.

Verse from Holy Quran –Surat Al Ana'am

Ayah 165 (6:165)

Climate change today is threatening our planet and in fact our very survival on earth .All countries and governments are concerned as we humans have contributed to this malaise. To find solution to any problem, we must first fully comprehend it. Hence Environment Agency – Abu Dhabi (EAD) in association with The Energy Research Institute (TERI) is adapting and bringing this save planet series of books on Climate change to children in the UAE with a hope that students as future custodians of our environment learn about what ails our mother earth, how each one us impact the environment through our actions, so that they are in a position to make appropriate decisions on matters that affect the health of our planet.

Climate change is expected to have direct and indirect impacts on earth. Scientists predict that we would lose nearly one third of our biodiversity, Sea levels would rise flooding low lying areas, face severe fresh water shortages , desertification , health issues such increased incidences of infectious diseases, heat strokes, forest fires, hurricanes and extreme and strange weather patterns to name some .

While governments are trying to fathom this new reality and looking at ways and means to tackle this global issue, it is becoming clearer to all, that only a concerted and collaborative action from each and everyone can actually help save this unique planet. United Arab Emirate too is aware of its responsibility and that is why despite being a country which is endowed with vast reserves of petroleum, a non renewable resource, and the one which contributes to climate change, it is working hard to establish the first carbon neutral city MASDAR in the coming few years and invest more on developing the renewable source of energy in the country. In addition, the country is also aiming to educate its future generation, through imbibing sound knowledge, imparting skill and helping to develop right attitude towards the environmental issues so as to prepare them to face any eventualities in the future.

We hope these books would be read by all students and would help them to understand the issue of climate change and the role that they can play in helping to save this unique planet.

CONTENTS

Nature's order

All living things on the earth such as insects, birds, fish, snakes, cows, plants, trees, and humans together make up the 'biosphere'. Just so scientists and people can study and understand the enormous living world, the biosphere is broken up into simpler parts called 'ecosystems'.

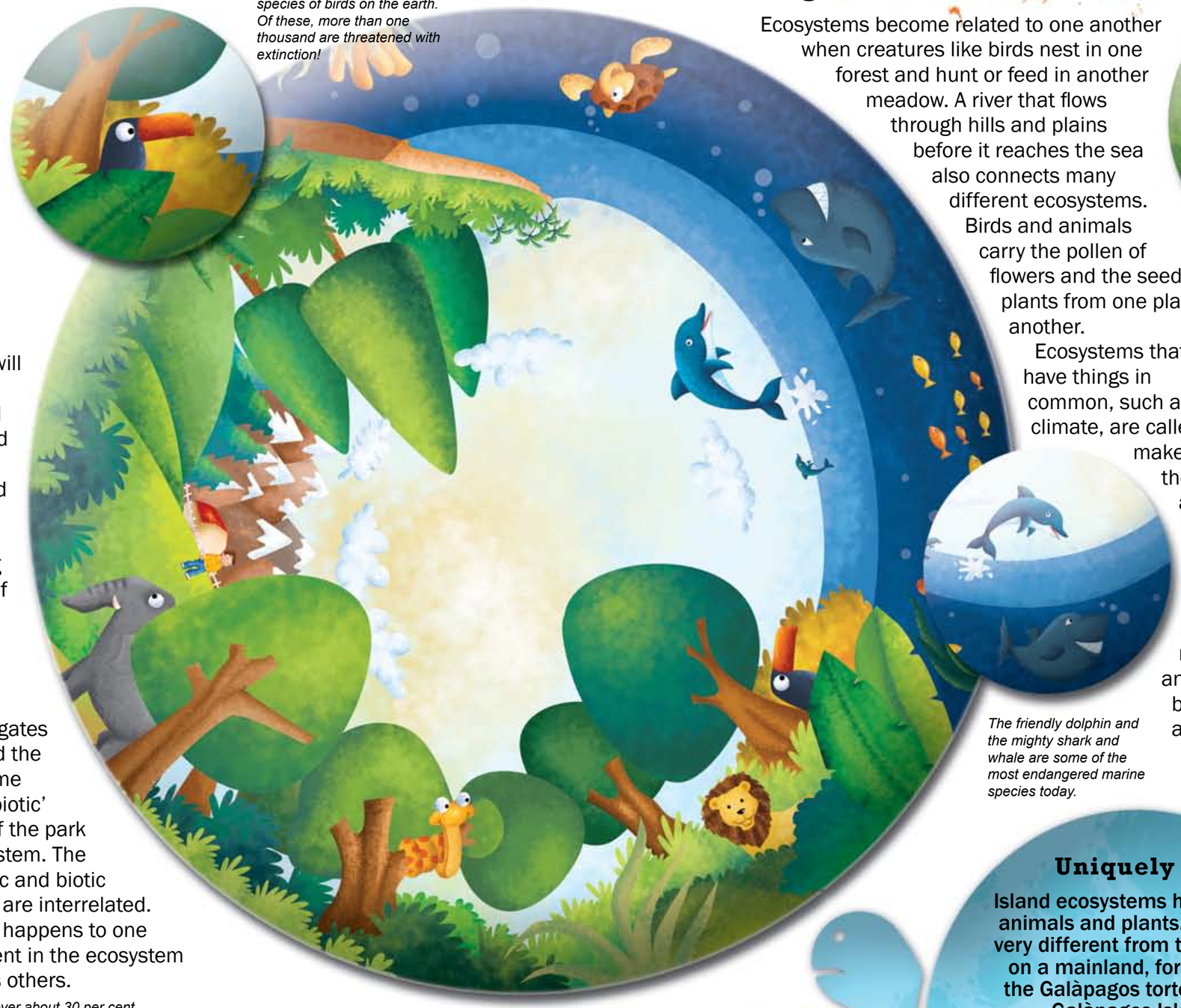
'B' for birds and for biotic

Spend a few hours in a park and you will understand the park ecosystem and how it works. Bees feed on nectar and pollen from flowers. Birds, spiders, and frogs feed on bees. Birds also feed on spiders, worms, and frogs. Snakes and owls feed on frogs and rats. Deer eat grass, and squirrels gather nuts from trees. All these living beings, including you in the park, are the 'biotic' parts of the park ecosystem.

'A' for all else that you see

Rain, sunshine, soils, rocks, the lawnmower used in the park, and the gates and fencing around the park are some of the 'abiotic' parts of the park ecosystem. The abiotic and biotic parts are interrelated. What happens to one element in the ecosystem affects others.

Forests cover about 30 per cent of the earth's land area.



There are nearly ten thousand species of birds on the earth. Of these, more than one thousand are threatened with extinction!

A + B = living world

Ecosystems become related to one another when creatures like birds nest in one forest and hunt or feed in another meadow. A river that flows through hills and plains before it reaches the sea also connects many different ecosystems. Birds and animals carry the pollen of flowers and the seeds of plants from one place to another.

Ecosystems that have things in common, such as climate, are called 'biomes'. What makes them different is the amount of sunlight and rainfall they receive. There are six land biomes: tundra, grassland, taiga, deciduous forest, tropical rainforest, desert, and two aquatic biomes—fresh water and salt water.

Did you know that reptiles are found in every continent except Antarctica!

The friendly dolphin and the mighty shark and whale are some of the most endangered marine species today.

Uniquely you

Island ecosystems have unique animals and plants. These are very different from those found on a mainland, for example, the Galàpagos tortoise of the Galàpagos Islands.

One big home...

Even though biomes may be far away from one another in different countries or continents, changes in one biome can directly or indirectly affect another biome. A volcano that erupts in Japan can bring down the temperature of the whole world by a few degrees and for several years.

Each biome has special plants and animals that live there.

Only animals like seals, polar bears, arctic hares, and foxes, and plants like lichen and mosses can survive in the tundra region, though migratory birds drop by in thousands.

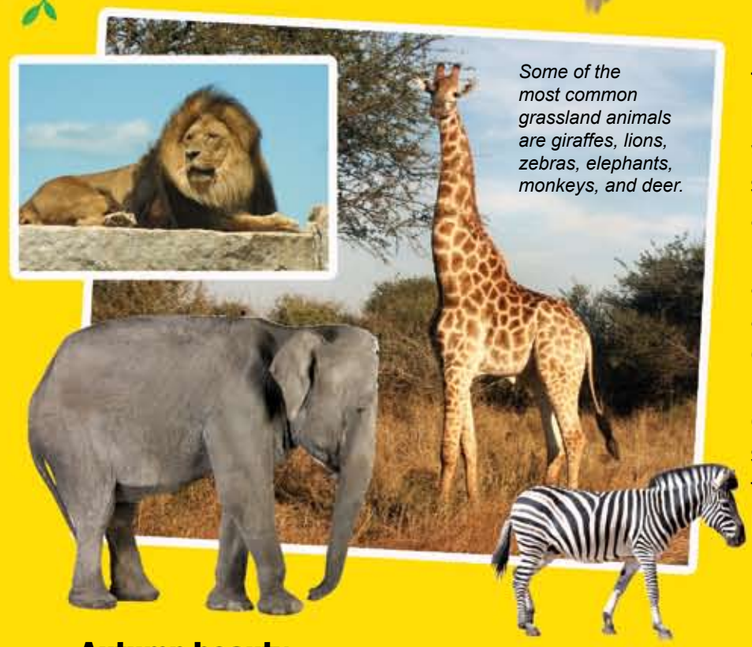
Chilled-out zone

The world's youngest biome is the Arctic tundra, near the North Pole. The winters are long and frozen, while summers are short and cool. Permafrost, the permanently frozen layer that lies just beneath the topsoil, makes it difficult for plants to grow.

The tundra is one of the earth's major carbon dioxide (CO_2) sinks. Plants here take in CO_2, which gets sealed in the permafrost when they die. This does not allow the CO_2 to be released into the atmosphere.

Brown meadows

Grassland biomes are places with hot, dry climates, vast lands of grasses, and sparse trees. In South America they are called 'pampas', in the US, 'prairie', and 'savanna' in Australia and Africa. Pampas and savannas are hot throughout the year but do have a season of heavy rainfall. The prairies have hot summers and cold winters. These grassy fields are ideal for growing cereal crops and grazing cattle.



Some of the most common grassland animals are giraffes, lions, zebras, elephants, monkeys, and deer.

Pine scented

The taiga, or coniferous forest, is the largest biome in the world. Its beautiful forests stretch over North America and Eurasia and cover over 17 per cent of the earth's land area. The summers are warm and rainy and the winters, extremely cold with snowfall.

The taiga cannot boast of diverse plant and animal life. In summers, birds migrate here to feed and nest while the insect population runs into millions.

Autumn beauty

Deciduous forest biomes have two things in plenty—human population and deciduous trees. Deciduous trees like maple, oak, beech, and hickory are tall and majestic, and some oak trees live for more than three hundred years! Bears, deer, wolves, squirrels, woodpeckers, and rabbits, among others, inhabit these forests.

Spruce and fir trees grow in abundance in the taiga region.

Deciduous trees shed their leaves in autumn. The leaves decay on the forest floor and become nutritious food for the soil.

Name game

There are more than sixty thousand species of trees of different shapes and sizes around the world! Does that leave you wondering about the people who came up with names for them?

With different rooms

Green, blue or brown; wet, dry or slushy, these biomes offer the perfect living conditions for species, many of which are still unknown to us and yet to be discovered.

Toucans, jaguars, orangutans, and lemur roam wild in rainforests. Bamboo, banana, rubber, and cassava are some common trees here.

People have used the rainforests for herbs, medicines, fruits, and foods for thousands of years.

Shades of green

Half of the world's plant and animal species are found in tropical rainforests in Asia, Africa, and Central and South America. Lush, dense, and green, these forests make 40 per cent of the oxygen on our planet.

Rainforests grow on mountains, plains, in river valleys or along coasts. These forests are very wet, getting about 180 centimetres of rain each year. Tall trees, measuring thirty to sixty metres, grow very close to one another, blocking sunlight from the ground. A combination of sun, shade, and rain makes these forests a perfect environment for over fifteen million plants and animals.

Sand and dunes

Desert biomes are dry places with very little water. Some deserts such as the Sahara in northern Africa, get very hot in the day and are very cold at night. Some like the Gobi Desert in Asia can be extremely cold. Not surprising then to find snow leopards there! Camels, coyotes, jackrabbits, kangaroos, snakes, and scorpions are some animals and insects that can survive the heat and live without water for long periods.

Plain or salted

Three-fourths of our planet is covered with water, and half the planet's oxygen is made by phytoplankton plants in the ocean. Ponds, lakes, streams, rivers, and wetlands that have less than 1 per cent salt make up the freshwater biome. This biome gives us our drinking water and water for crops to grow.

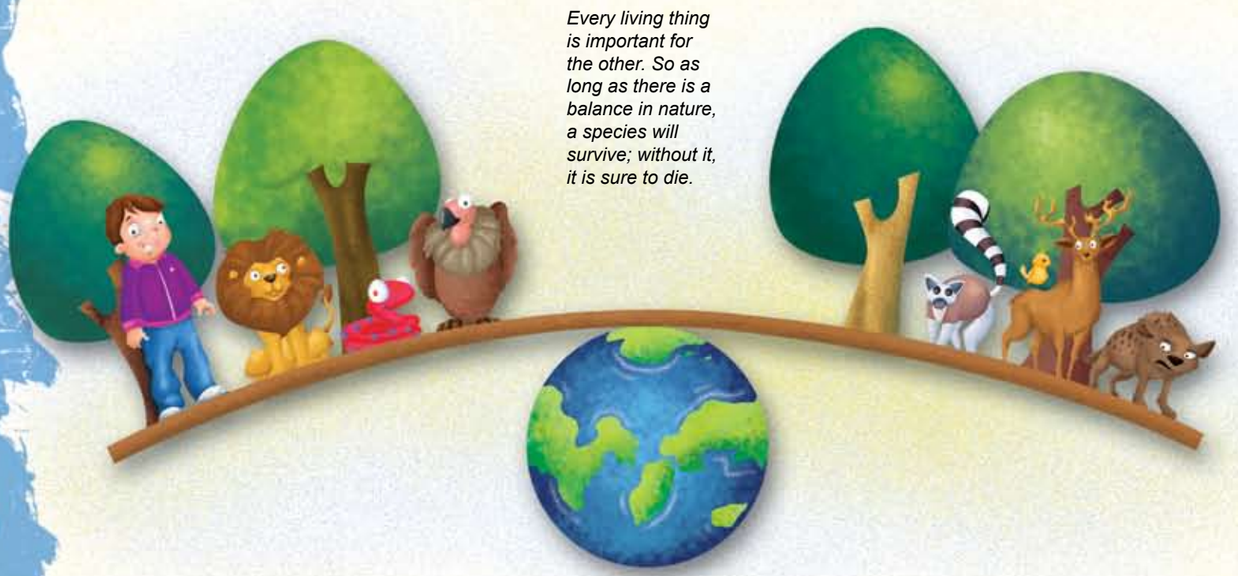
One world

In Biosphere 2 at the University of Arizona, Phoenix, visitors can experience all the biomes under one roof! This biome building is a research centre that also teaches and shares information about the earth and its living systems.

Home to several thousand species of sea life – fish, whales, octopi, crabs, lobsters, dolphins, and turtles – oceans also give food to people.

The balancing act

For billions of years there has been life on Earth. How is that possible? The sun is like the fuel in a vehicle. Heat and light from the sun give energy to all living things on the planet and help them grow. The atmosphere, or air around us, water, and sun combine to give us rain, seasons, oxygen as well as life and food.



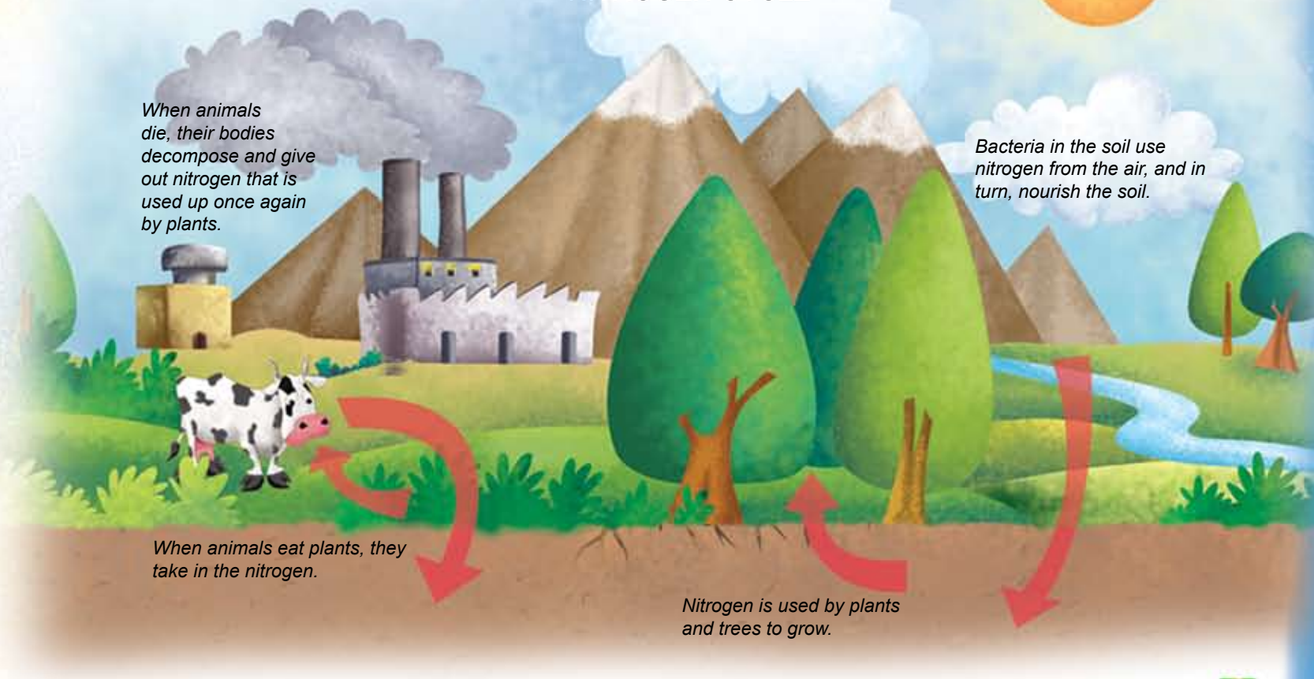
Every living thing is important for the other. So as long as there is a balance in nature, a species will survive; without it, it is sure to die.

Eat to live

All living things on our planet feed on something. A food chain of 'who feeds on what' always starts with plants, since they are the only living things that make their own food. When a deer eats grass, it uses the nutrients and energy in grass. When a lion eats that deer, the energy from the grass and the deer are passed on to the lion. Finally, when the lion dies, it passes its energy to vultures, hyenas, and bacteria in the soil. This energy is used up by the grass once again. Normally, a food chain is made up of six levels, though aquatic food chains are longer.

Groups of plants, animals, insects, and aquatic animals are involved in different food chains in an ecosystem. These are connected to one another for survival and together make a food web.

NITROGEN CYCLE



When animals die, their bodies decompose and give out nitrogen that is used up once again by plants.

Bacteria in the soil use nitrogen from the air, and in turn, nourish the soil.

When animals eat plants, they take in the nitrogen.

Nitrogen is used by plants and trees to grow.

Round and round

The atmosphere is made up of gases – about 20 per cent oxygen, 79 per cent nitrogen, and 1 per cent other gases. Carbon is a material, or substance, present in all living things, including diamonds and petrol. It is also contained in carbon dioxide gas. Humans and animals breathe in oxygen and breathe out carbon dioxide. Plants use carbon from the carbon dioxide found in the air, along with water and energy from the sun, to make their food, and give out oxygen. The use and reuse of carbon makes up the 'carbon cycle'.

On the menu

A herbivore is a creature that eats only plants, a carnivore eats only meat, and an omnivore eats both plants and meat. Frugivores eat fruit, piscivores eat fish, and sanguinivores drink blood!

The human bug is spreading fast!

Medical report of Planet Earth

1. Global temperature rose by 0.74 degree Celsius in the last twenty-five years.
2. Carbon dioxide in the atmosphere is 30 per cent more than it was hundred years ago.
3. The ozone hole above Antarctica is getting larger.
4. Twenty per cent of wetlands around the world have vanished.
5. Glaciers and polar ice sheets are melting very quickly.
6. The world population has grown more in the last fifty years than it did in four million years.

Diagnosis

Sick and warm.

Causes

A bug called humans.

Advice

Operation 'Educate the Humans' suggested.

Bugging effects...

A forest area the size of a football field is destroyed by people every two seconds. Giant trees from the Amazon forest, some over a thousand years old, are chopped down to make paper or tissues!

...in air

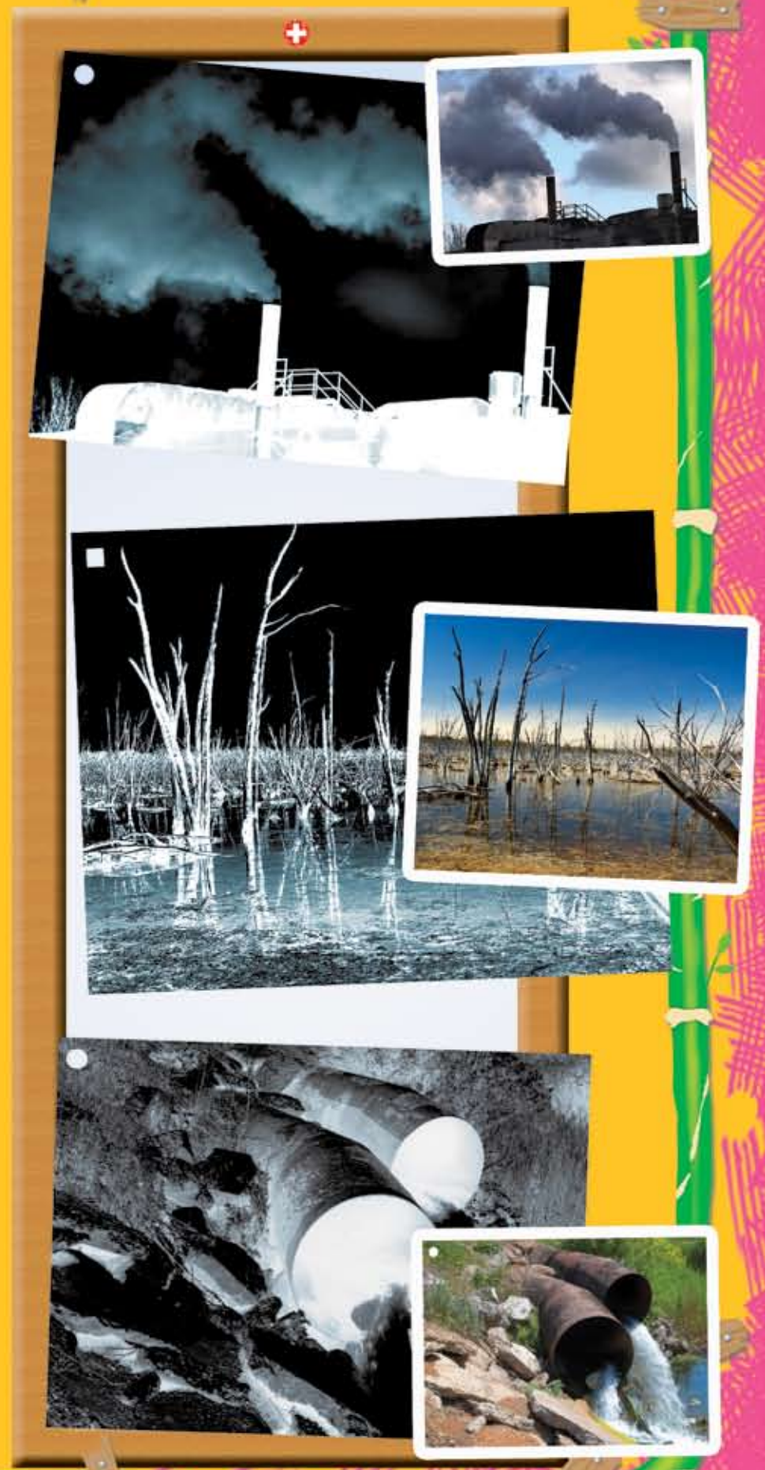
Burning diesel, coal, and petrol in vehicles and factories gives out greenhouse gases like carbon dioxide and methane, which are known to raise global temperatures. With fewer forests for cleaning up the carbon dioxide in the air, pollution levels and temperatures keep rising.

...on land

With more people on the planet, there is huge pressure on countries to build homes and industries, mine minerals, and grow more food. Cutting down trees, clearing forests for farming and settlements, and mining for thousands of years have destroyed the natural air conditioners and pollution cleansers of the planet. In Russia, the land around some nickel mines has become so degraded that plants in the area have died.

...in water

Chemicals and fertilizers used in farming, along with household and industrial wastes, flow out or are dumped on the soil or into rivers and oceans. These poison not just plants and animals but also our drinking water and the food we grow and eat. Human activities such as shipping, dumping wastes, and offshore oil production cause 80 per cent of all marine pollution.



Home under siege!

Habitat is the home of a particular species. It is the natural environment of a living creature, which means that the creature lives, reproduces, finds its food, and thrives in that surrounding.

Just as people live in one place but shop, work, vacation or go to school in another, so do living things in the wild. Many waterfowl nest in upland habitats but feed from nearby wetlands. Migratory birds like starlings have summer and winter homes in different continents.

Starling numbers have fallen by 66 per cent in Britain since the mid-1970s.

Save as...

Scientists in the UK have collected a billion plant seeds from around the world and frozen them at sub-zero temperatures. This 'collection' is being made in case there is complete habitat destruction due to natural disasters, war or epidemics, and the species are lost to us forever!

Be kind to us...

Even if you have never stepped into a wetland, you still enjoy the luxury of clean water in your tap, which has been purified by it. Wetlands are natural filters and purify water by trapping the pollutants. Throughout the United States, there are about 600 manmade wetlands that actively treat wastewater generated by farms, cities and industries. We also use a few things from the rainforests like paper, nuts and coffee without much thought to where they came from...

...and we will be cruel to you!

It has taken sixty to hundred million years for the oldest land-based ecosystem, our Earth to grow but only forty years to wipe out 20 per cent of it. More than half of the planet's wildlife and about 70 per cent of plant varieties have their habitat here.

Coral reefs are the largest living structure on Earth but 5%–10% of them around the world have already been destroyed. Twenty-five per cent of all marine species live in reefs and by 2050, 70 per cent of the reefs might vanish from the face of the earth!

Sixty to 70 per cent of European wetlands have been completely destroyed.

Less than 0.1% of tropical deciduous dry forests remain in Central America's Pacific Coast.

Mangrove forests that once stretched along three-fourths of the coastlines in tropical countries have now been halved and are reducing.

More than half the earth's forests have disappeared forever.

When animals and plants lose their homes, they not only become misfits in the changed habitats but also face the danger of dying out.

Sounding the red alert

There are hundreds of animals and plants around the world that have become so few in number that it is feared they will soon become extinct. Threatened animals or plants are those whose numbers are reducing quickly, and hence they are likely to become endangered.

Who knows?

The World Conservation Union (IUCN) does. They created a Red List in 1963, which examines the risk of threat and endangerment faced by plants and animals. Every five or ten years, this list and the status of those on it are rechecked. The idea is to inform and educate people and governments to take action and control the threat to species. The Red List has 40,177 species, 16,119 of which are considered to be endangered.

Is it us?

Mostly yes. For food or fur, for wood or water, humans have deprived other living beings of shelter, food, nesting grounds, and a pollution-free environment. This has happened so rapidly that some species have not had a chance to adjust, adapt or evolve.

Another cause of species endangerment is when a non-native plant, animal, fish, bacteria or virus is intentionally or accidentally introduced in a new habitat. Eventually it does adjust and belong, but in the process, it upsets the food web and food chain.

Natural disasters like floods, droughts, tsunamis, and diseases and epidemics also destroy habitats as well as species.


Tiger


Pink and red corals


Hawksbill turtle


Giant panda


The great apes (gorillas, chimpanzees, and orangutans)


Rhinoceros

Red alert!

The top ten most endangered species according to the World Wide Fund for Nature (WWF) are:

- Porbeagle
- Sawfish
- Tiger
- Spiny dogfish
- Red and pink coral
- Asian rhinos
- European eel
- Elephants
- Great apes
- Bigleaf mahogany

Countries with the largest number of threatened species

Indonesia	Mammals
Brazil	Birds
Mexico	Reptiles
Columbia	Amphibians
US	Fish Molluscs Other invertebrates
Ecuador	Plants

Forever yours

The squirrel that hoards nuts during summer, the falcon that hunts for hours to feed its young, the Arabian leopard that defends its territory in the high mountains of Arabia, the elephant that fiercely protects its calves: all these creatures protect, save, manage or store what is important to them. They all 'conserve'.

What

Conservation is saving and protecting wildlife, forests, water, and land. All of these are nature's resources or valuable possessions. If they are damaged or in short supply, some of them can be mended or repaired. They can be unlimited if used and managed intelligently.

Coal, oil, and natural gas are obtained from the earth and are limited in supply. Therefore, it is even more important to conserve them to make sure they last a long, long time and are not wasted.

Coal, oil, and natural gas are the earth's non-renewable resources.

Who

A conservationist is someone who works to protect the environment and species from pollution and finally, destruction. S/he can do this in many different ways—by teaching at schools and colleges, by conducting research in laboratories or in the field or even by working with governments and international organizations like the World Wide Fund for Nature (WWF).

Why

Conservation is saving not just for oneself but also for others who will live on the planet years later. It is an effort made for future generations to enjoy clean drinking water, fresh air, forests, and a healthy balance of them all.

Just as people need to exercise and eat right to stay fit and healthy so also does the earth need to be looked after. If we want clean air and water, medicines from forests, recreational outdoors, and fossil fuels, then we must take care of our planet.

Recycle, turn off lights when not needed, and donate books and clothes that you do not use anymore.

Humans have the sole responsibility of keeping the earth healthy because they can and they ought to. You too can become a conservationist!

The last resort?

Conservationists have listed thirty-four 'biodiversity hotspots', or those places on the earth that have some plant and animal species found there alone. These hotspots have at least 1,500 species of plants but have lost at least 70 per cent of their original habitat. Some of them are the Western Ghats in India, the mountains of southwest China, tropical Andes, and the Caribbean Islands.

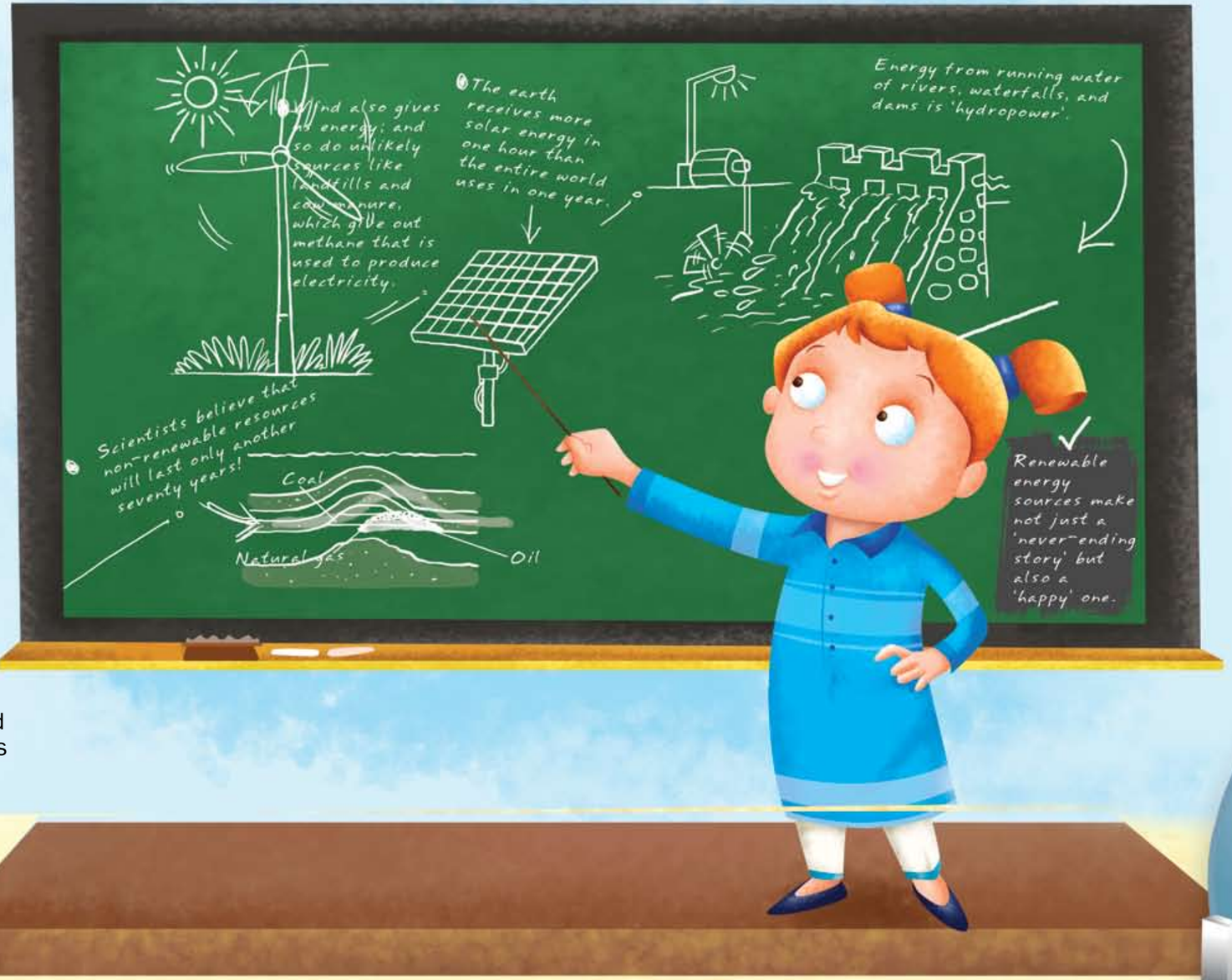
Full of energy

People have it, cars have it, and the sun has it, and so does water. Fans, toasters, air conditioners, and televisions are some of the things that use it. Energy is the power that makes these things work, and it is obtained from the earth and nature.

Use it and lose it!

Non-renewable energy resources once used are gone forever. They cannot be made again in a short time. Coal, petroleum, and natural gas were formed naturally over millions of years in the earth from dead and buried animals and plants, even before dinosaurs walked the earth.

These sources produce 66 per cent of the world's electricity and power 95 per cent of its vehicles, industries, and homes.



Never-ending story

Hydropower is the champion of all renewable energy resources and 20 per cent of electricity worldwide is produced by hydropower.

Non-polluting and free forever is the energy from the sun (solar energy). The high cost of solar power stations and the fact that it is not a dependable source in shady places, are some of the reasons for its limited use.

Saving it all

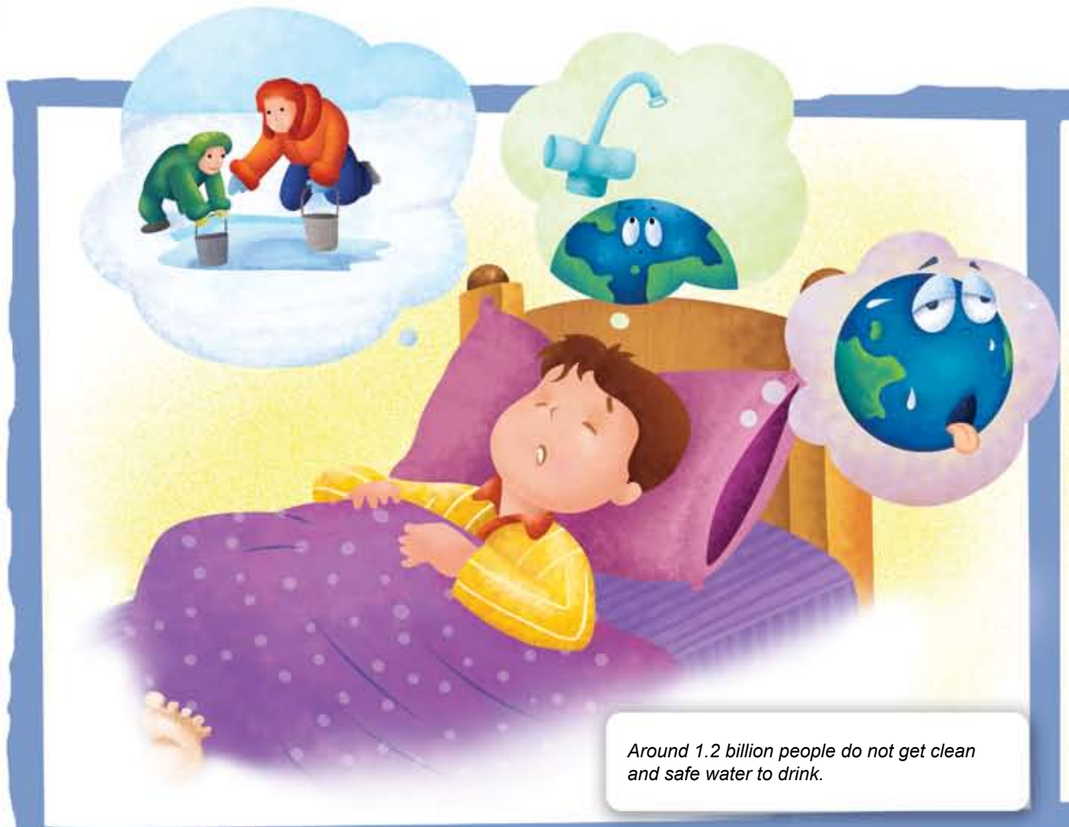
Although wind and solar energy are good for the environment, they cannot be stored, and so people continue to depend on non-renewable resources. Using energy intelligently helps save and conserve energy—not forgetting money saved on electricity bills!

Beam it down, Scottie!

Scientists are studying the possibility of orbiting satellites in space to capture the sun's energy and beam it down on the earth for us to use it as clean energy, forever.

$H_2Oh!$

They don't call it 'blue planet' for nothing. More than 72 per cent of the earth is covered with water. However, only 2.5 per cent of the water on the earth is fresh water, or drinkable, and most of it is frozen in ice caps. Humans have only 1 per cent of fresh water available to them.



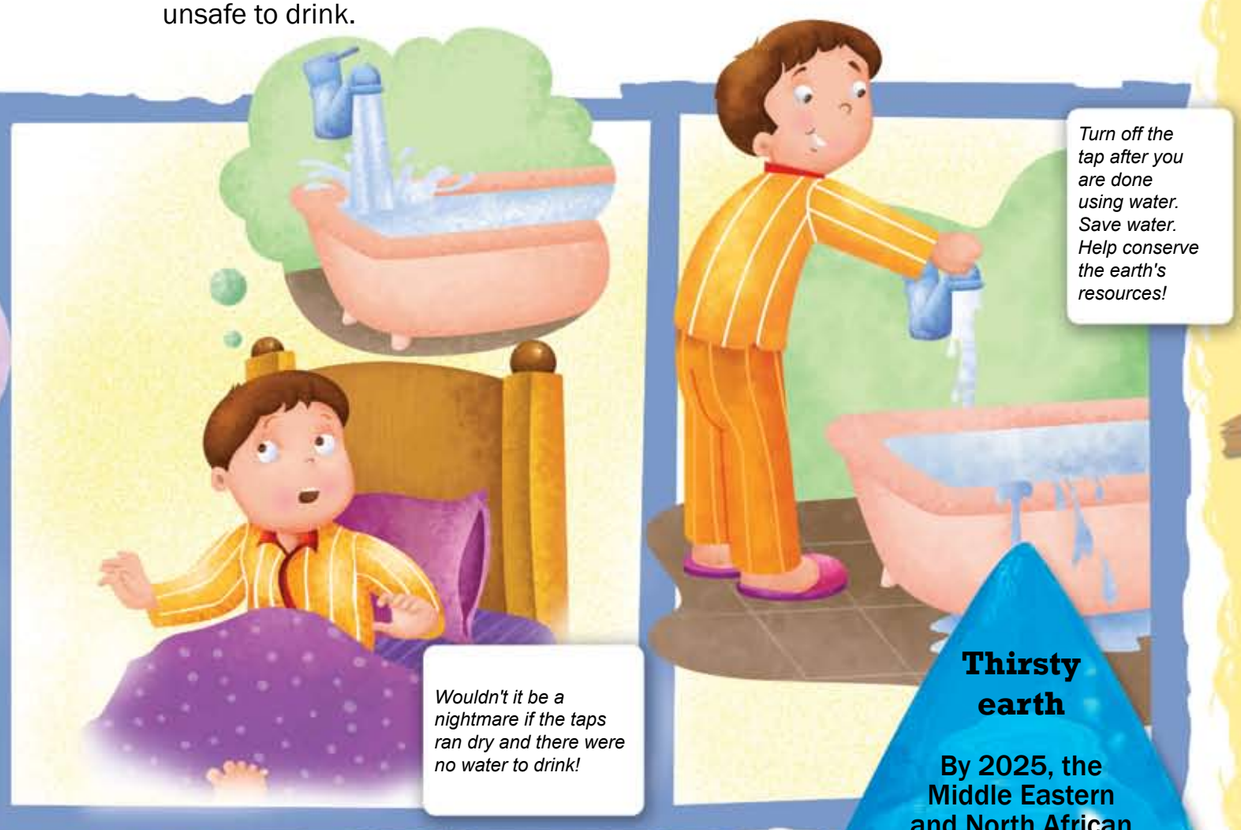
Water, water everywhere

Sixty-nine per cent of fresh water is used to grow food, 15 per cent is used in industries, and 15 per cent is utilized for drinking, bathing, cooking, and gardening.

Fortunately, fresh water is a renewable resource. Rain and melting snow flow into streams, lakes, and rivers (surface water) and also into aquifers or wells in the ground (groundwater). People in different parts of the world get their water from one or both of these places.

What a waste!

You would not dream of reusing your bath water because it is dirty. Yet, this water has to go somewhere. Waste water is somewhat cleaned at water plants and then dumped into rivers, lakes and oceans. Despite the clean up this water still carries some impurities and toxins. Some of these toxins in the water are naturally cleaned by the soil and rocks in rivers and lakes but many others linger on for hundreds of years. Fish, marine life, birds, and animals that drink this water die and many species struggle to survive. Chemicals also soak into the groundwater, making it harmful and unsafe to drink.



Fix that drip!

While countries need to control their pollution levels and clean up their mess, there is plenty that you can do to save water. Turn off the tap while brushing teeth, fix leaky faucets, take shower baths instead of tub baths, wash full loads of clothes in the washing machine, and water the garden and plants early in the morning or in the evening.

Thirsty earth

By 2025, the Middle Eastern and North African countries, along with Pakistan, India, South Africa, and China, will not have enough water for their industries and for growing food to feed their people.

Down to earth

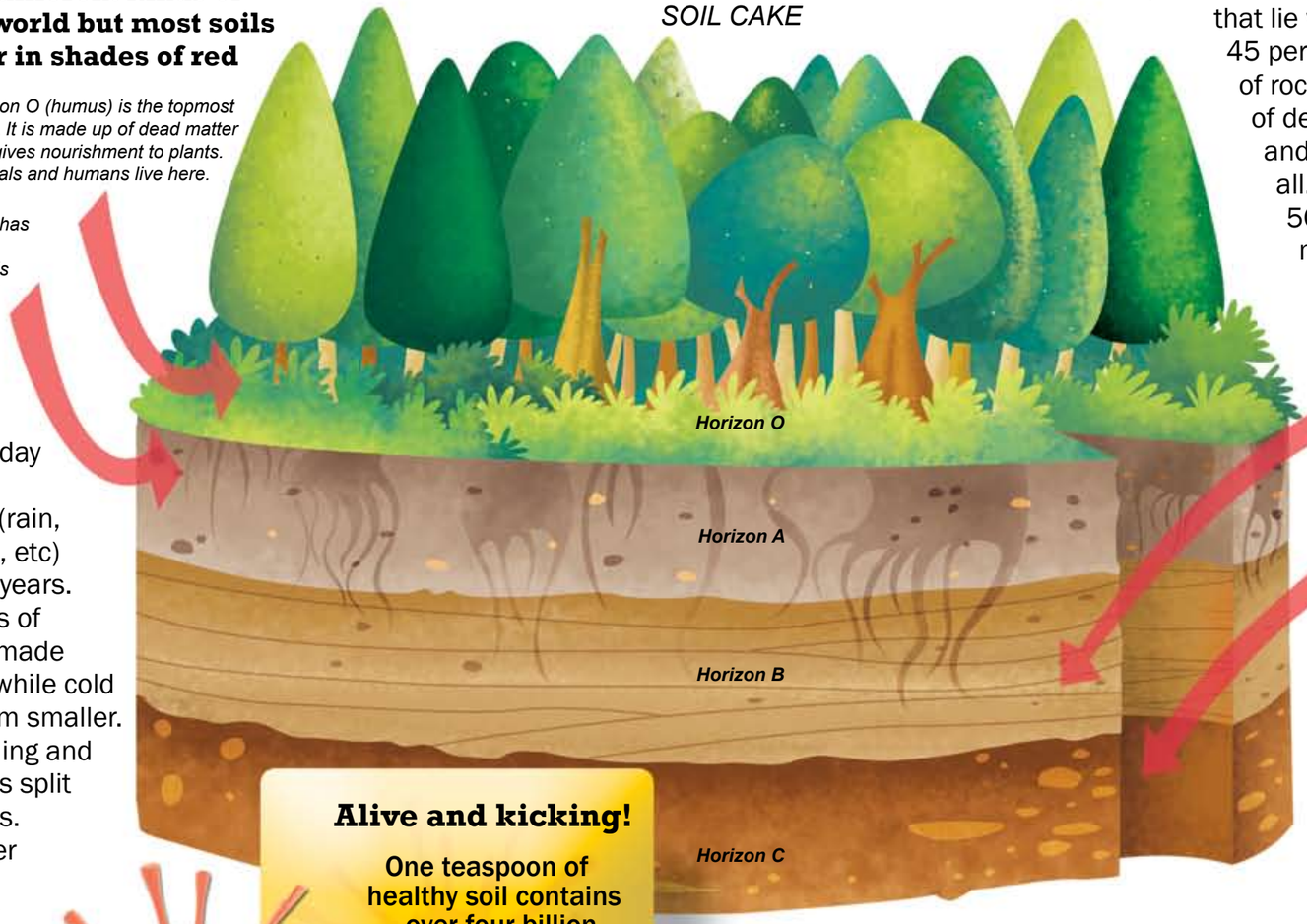
Out in the open, it's there for everyone to see. It is everywhere and people walk on it all the time. And, it's not dirt we are talking about, but soil. Soil is the outermost layer of the earth and a part of the environment. There are thousands of different kinds of soils around the world but most soils are black, grey or in shades of red to yellow.

Who soiled it?

The soil you see today was made by the changing weather (rain, sunshine, snowfall, etc) over thousands of years.

Over long periods of time, hot weather made rocks grow bigger while cold weather made them smaller. Due to this expanding and shrinking, the rocks split into smaller chunks. Rain and ice further lashed these chunks, crumbling them into smaller pieces to give us the soil we have today. It takes five hundred or more years to make one inch of soil.

SOIL CAKE



Horizon O (humus) is the topmost layer. It is made up of dead matter that gives nourishment to plants. Animals and humans live here.

Horizon A is the topsoil. It has plant roots, bacteria, fungi, worms, and insects. It holds plants and trees down and prevents them from falling.

Horizon B forms the subsoil. It is mostly clay here but also has minerals like iron and calcium carbonate.

Horizon C is the bedrock

Alive and kicking!

One teaspoon of healthy soil contains over four billion micro-organisms! That number is close to two-thirds of the human population on the earth.

Wanted – dead or alive!

Soil scientists, or pedologists, know that soil is made up of living and dead things. Soils have a basic combination of sand, silt, clay, and other dead matter. Twigs, leaves, dead bugs, living insects, rocks, and stones are some of the things that lie within. While 45 per cent of the soil is made of rocks, 5 per cent is made of dead and living plants and animals. But that's not all. Air and water make up 50 per cent of the soil, making it very much alive.

Soiled rotten

Yes, even soil is dirtied! Dumping of waste from industries and homes, overuse of chemicals and toxic pollutants, and weed killers are some of the things that dirty soil and, eventually, harm all living beings.

Home to moles, caterpillars, beetles, snakes, rabbits, and a million other species; oxygen giver for all living things; and a great record keeper of life on Earth, soil is as important for the earth as air and water.

Soil conservation is important because a healthy soil gives us healthy food.

Rocks weather and crumble into tiny chunks till they become fine soil—a process that may take thousands of years.

Over a period of time, grasses and plants start to grow.

The bedrock has rocks that have not been broken down by weather.

Rx fire: fire prescription

When you think of fire you probably picture early man cooking on it or using it to scare away wild beasts. Those were 'good fires'. As time went by, natural, accidental, and uncontrollable fires caused destruction to life and property and wiped out human settlements. Those were 'bad fires'.

Humans have learned to turn 'bad fires' into good ones. Around the world, people use the destruction of fire for conservation. A planned or 'prescription fire' prevents the outbreak of wild forest fires.

In fire-dependent ecosystems, plants and animals have adapted to the frequent fire spells. Birds and animals either run away from the fire or take shelter in holes or on tree tops.

Big, bad, and destructive

About 106,400 wild fires break out around the world each year. Nine out of ten are badly planned attempts to clear forests or started by people accidentally.

'Bon' fire

Prescription fire is used for many reasons. Forests where the insect population has boomed out of control or where disease has infected crops, qualify to be burned. A ground cover that is layered with leaves and dead trees is burned to allow new plants to sprout. In fact, longleaf pines need fire for their seeds to burst out for new trees to grow.

Wild about fire

There are many fire-dependent ecosystems around the world, which thrive, or do well, with the natural outbreak of fire. These ecosystems cover about 53 per cent of land on the earth. The forests in the Assam hills in India and almost all of Northern America, the eucalyptus forests in Australia, and the taiga forests in Siberia are some such places. Without fire these ecosystems would lose their species of plants and animals.

Fire ecologists identify the location that needs to be set on fire and decide if the fire should be set into or against the wind.

Aim, fire!!!

Fire ecologists, or scientists, know how, when, and where to set fires. Fires are set in different ways—dropped from helicopters, alighted in a circle on the ground, set up slope or down slope, and even in neat rows. Whatever the method, some fire is good for many ecosystems around the world.

Alien invaders

Pretty pinks, sunny yellows, lush, shiny greens, fragrant flowers: some of the gorgeous disguises these invaders wear. They come in all shapes and sizes, move or are stationary, and multiply so rapidly that they cloak everything in their surroundings. These are invasive species. They are plants, animals, insects, trees, and herbs that are inhabitants of a certain environment. When they enter a new habitat away from their own home, they cause damage to the nearby environment, to agriculture as well as to human health.

Invasive plants produce large amounts of seeds in their new environment, which are carried far by birds and winds. This gives them a high chance of survival and germination.

Halt! Who goes there?

Many invasive plants like the black locust are innocently used as decorative pieces by gardeners for landscaping. In fact, 60 per cent of all invaders are used in botanical gardens and arboretums.

Some 10 per cent of the plants are accidentally carried across countries in cargo ships, airplanes or trucks. Tourists also contribute to this transportation when they take back home exotic species from their travels.

Prevention...not a cure!

About 30 per cent of invasive plants are planted by conservationists to conserve soil. They are positioned as barriers to prevent soil erosion. They are also planted for food and cover for wildlife. However, most often the seeds and fruits of these plants are not nourishing and end up becoming 'junk food' for birds and animals.

Enemy operations

Some invasive plants have long, wide, and strong roots that spread out underground and choke other plant roots. Some others flourish just about anywhere—along highways, in streets, and in parking lots. The tree-of-heaven is one such plant. It grows easily in cities as well in fields and forest openings.

Clever invaders like the velvet tree spread out and make a canopy under the shade of which no other plant, except its own seeds, can survive. Invasive plants grow into drainage pipes, blocking them; kill shade trees; spread out in lakes and wetlands; and take over homes of birds and animals.

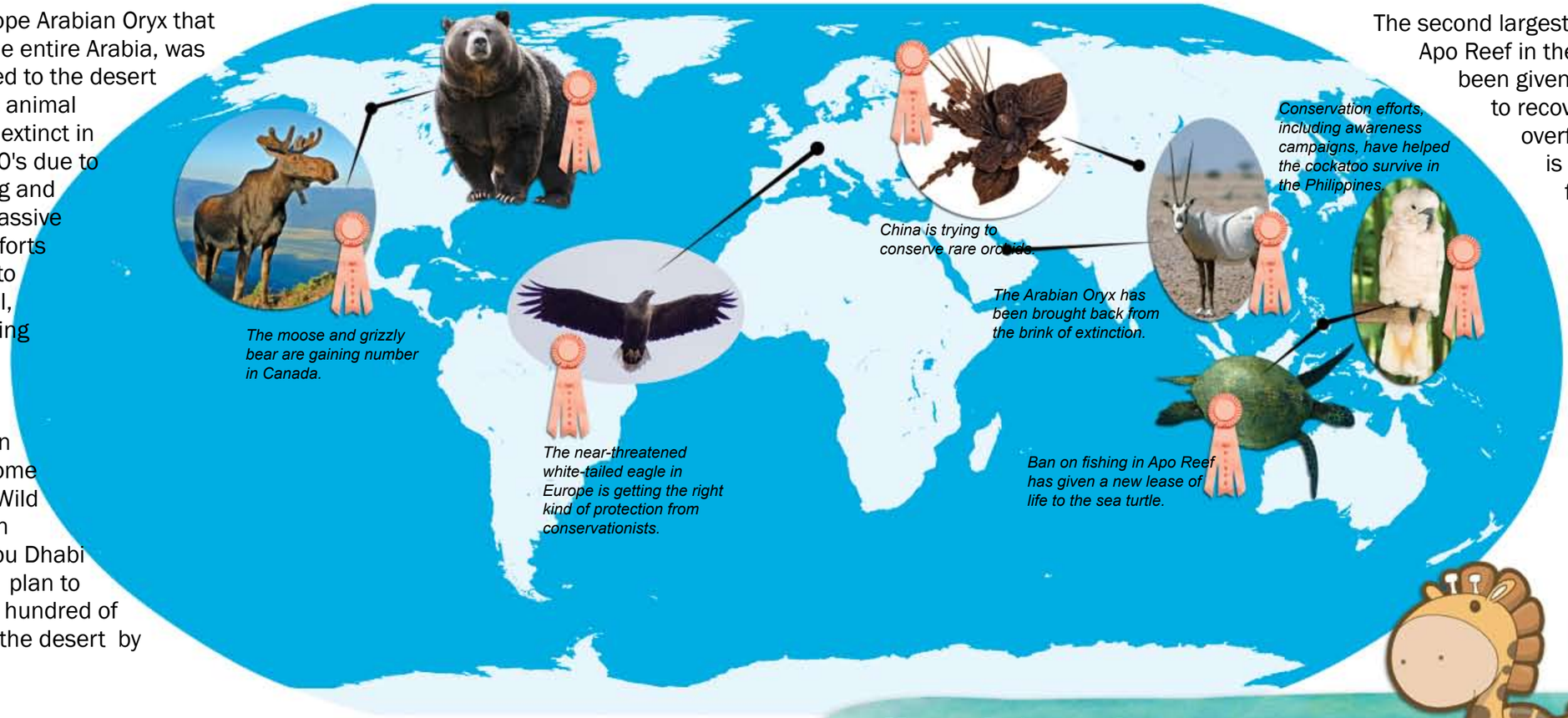
It is believed that the loss suffered worldwide from the effects of invasive plants on ecosystems, water, and crops is about five trillion dollars!

Conservation paying off

It's not all a gloomy picture. Where there is a will there is a difference. Conservationists have been making huge efforts to save, protect, and revive disappearing species, and their efforts have been paying off.

Three chirps for conservation!

The regal antelope Arabian Oryx that once roamed the entire Arabia, was superbly adapted to the desert conditions. This animal became largely extinct in the wild by 1960's due to exessive hunting and habitat loss . Massive conservation efforts were launched to save this animal, including breeding in captivity. As a result this beautiful animal has been introduced in some countries now. Wild life conservation specialists in Abu Dhabi Emirate, in UAE plan to reintroduce five hundred of them back into the desert by 2012.



The moose and grizzly bear are gaining number in Canada.

The near-threatened white-tailed eagle in Europe is getting the right kind of protection from conservationists.

China is trying to conserve rare orchids.

The Arabian Oryx has been brought back from the brink of extinction.

Conservation efforts, including awareness campaigns, have helped the cockatoo survive in the Philippines.

Ban on fishing in Apo Reef has given a new lease of life to the sea turtle.

Striking the balance

Wild life conservationists in Abu Dhabi, UAE have taken tremendous efforts to conserve the houbara bustard, a migratory bird that migrates to Arabia in the winters. This endangered bird is being bred in captivity, and at the same time protected in its natural habitat.

In the deep end

The second largest reef in the world, Apo Reef in the Philippines, has been given a second chance to recover from years of overfishing. The area is a nesting ground for many marine species like sperm whales, sea turtles, sharks, and rays. Fishing and coral collecting have now been banned.

Getting wiser

The European Commission has added 4,225 new habitats under a habitat protection plan. Caring for these areas would not only mean cleaner air for the Europeans but also ensure the safety and survival of thousands of species.

The tropical rainforests in Peru, about the size of France, are now being saved from damage and destruction by conservationists. They are using satellite systems to track changes in the forests right down to a tree fall!

Name their togetherness

A group of cattle is called a herd. Here are some unusual group names.

Lizards	lounge	Jays	scold
Flies	business	Goldfish	troubling
Hippos	bloat	Cats	pounce
Giraffes	tower	Cormorants	gulp

You and your conservation

If it's April 22, then it must be Earth Day! It's a day when countries all over the world celebrate one common gift all humans have—the earth. You do not have to wait for the next Earth Day to do your bit to save the planet. Every day can and should be Earth Day!

Wake up sleepyheads!

Reading and educating yourself about climate change, endangered species, water shortages, energy conservation, and other earth matters will not just keep you in the loop but also urge you to think about things around you, which you might be taking for granted. Look at your water and electricity bills over three months and find out how much your family consumes. Compare notes with friends and challenge one another to reduce your bills. Think about what you buy and how you will dispose of it.

Recycle paper, aluminium, glass, motor oil, and batteries.

Eat locally produced fruits and vegetables.

Say 'No' to meat of endangered species.

Turn over a green life!

Buying recycled products is good for the earth.

You might find this fact hard to digest: What you eat contributes to deforestation and pollution! More and more forests are being cut down to grow food, which is then transported around the world.

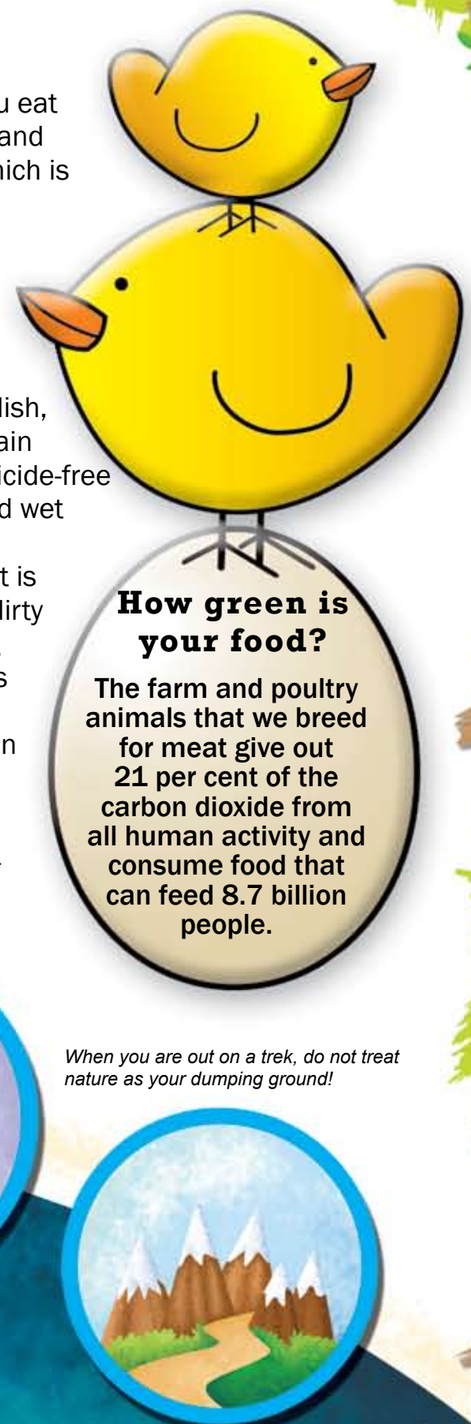
Eat locally grown food. Make your own compost, too, with broken eggshells, tea leaves, and fruit and vegetable peels, and watch your garden grow!

Have a h-earth!

Laundry soaps, household cleaners, furniture polish, paints, fertilizers—eventually all flow down the drain and into the soil and rivers. Phosphate- and pesticide-free soaps and cleaners work just as well. Vinegar and wet newspapers make great window glass cleaners.

When out in the wild on a hike or a trek, it is important not to disturb or dirty the environment. Taking home bugs and seeds from the wild could result in an invasion of wild species!

Use vermicompost instead of chemical fertilizers.



How green is your food?

The farm and poultry animals that we breed for meat give out 21 per cent of the carbon dioxide from all human activity and consume food that can feed 8.7 billion people.

Be judicious in the use of paints, thinners, polish, and so on.

When you are out on a trek, do not treat nature as your dumping ground!

Long live...and forever!

These are the natural wonders of the world. They have roughed harsh and extreme climates and survived. Today, their biggest threat comes from humans. If they are not conserved, these wonders will vanish, taking with them thousands of species seen nowhere else on the earth.

Antarctica

The earth's southernmost continent is unbelievably cold with 70 per cent of our planet's fresh water frozen there as ice. No human population lives there though about five thousand scientists and twenty-five thousand tourists visit each summer. Only six species of seals and twelve species of penguins live and breed there. Birds found there are migratory.

Orange, yellow, and green lichens and mosses dot the white landscape, making for a spectacular sight.

Amazon Forest, South America

This rainforest is the largest and densest in the world, giving out 20 per cent of the oxygen on the earth. In few other places would one be able to see 50,000 varieties of plants, 2,500 kinds of fish, 1,500 species of birds, 1,800 types of butterflies, and about 200 different kinds of mosquitoes!

Great Barrier Reef, Australia

It looks visibly stunning from space but get closer and its beauty only gets magnified. The Reef is eight thousand years old and a collection of three thousand reefs made up of exotic corals, some of which are over a hundred years old. Green turtles, bottle nose dolphins, and humpback whales are some of the inhabitants of the reefs, along with thousands of sponges, anemones, sea stars, and urchins.

Grand Canyon, Arizona

The Grand Canyon rocks were formed millions of years ago but even today they continue to be chiselled and shaped by the mighty Colorado river. Some fascinating creatures roam the deep reddish-brown-coloured landscape—lizards, bighorn sheep, coyotes, elks, mountain lions, golden eagles, peregrine falcons, and rattlesnakes.

Search

Angel Falls, Venezuela

Free falling doesn't get higher than this. The Angel Falls is the world's highest waterfall at 984.5 metres (twenty times the height of Niagara Falls) with an uninterrupted drop of 807 metres.

Himalayas, Asia

Forty million years ago stood India and Eurasia. They moved, they collided, and they came together to form the Himalayas. Stretching 2,900 kilometres on the Indo-Tibetan border, this mountain range is ruled by the mighty Mt Everest—the world's highest mountain!

Amazing discoveries

Not everyone knows everything. And, the more we know, the more we realize how little we know. Sometimes scientists find themselves feeling a little speechless but mostly surprised. Sometimes, they stumble upon something entirely new, and sometimes, they go out there looking for it. They are still discovering new species, and as they do, we get to learn more about our amazing planet.

A whole new world!

Living deep down in 60 degrees celcius water, inside a goldmine, completely isolated from the rest of the world, with no light or oxygen is no mean task. But scientists have discovered a bacterium 'Candidatus Desulforudis' nicknamed the 'bold traveller', far removed from any other form of life. This could perhaps be a peep into what alien life might look like!

The shrimp-like crustaceans found in the dark caves are blind—an adaptation to the darkness they have lived in!

Do and die!

Discovered in Madagascar in 2008, the trunk of the giant palm grows eighteen metres tall and its leaves fan out almost five metres in diameter. What makes this tree unique and bizarre at the same time is the fact that when it flowers, its nectar attracts hundreds of insects and birds. As soon as the flowers turn into fruits, the entire tree collapses!

The giant palm is so enormous that it can be caught on space satellite cameras!

Croaked in secrecy

Though this toad will certainly never turn into a handsome prince, it had scientists very excited when they found it along with other species in Suriname in South America in 2008.

The frog discovered in Suriname has a shiny black wet appearance with fluorescent purple markings.

A taste for rats!

A new and rare species of the pitcher plant, called Tenax, was unknown to the world till now. Growing in a small swampy area in Cape York, Australia, the exact location of this find is kept a secret by scientists who wish to protect its survival.

Although pitcher plants are known to be flesh eating, the new species has a taste for small rats!

Finding the shrew

Even though its size is anything but huge, it belongs to a family known as giant elephant shrew (sengi family). They call it the grey-faced sengi. The shrew is small and furry with a miniature version of an elephant's trunk that helps it locate its insect diet.

The grey-faced sengi is related to the elephant, manatee, and aardvark!

Lost and found

Scientists believe that even a moderate increase in global temperatures could result in the extinction of 20%–30% of the entire world's species of animals and plants.

Did you know?

On November 28, 2007, a record seventy-nine million trees were planted in Indonesia. The country has had a reputation for cutting down 63 per cent of forests to grow, ironically, palm olive plants—to be used as a 'green' bio-diesel fuel.

Noise pollution has been increasing in the water world and is particularly distressing for sea animals like whales and dolphins that use sound to locate their position. While trying to avoid noisy boats these creatures often miscalculate their location, especially while migrating, and often get stranded on beach shores.

The dust covering the bulb blocks out almost half of the light the bulb gives out. When you switch on a clean incandescent light bulb, it gives out only 10 per cent of the electricity as light—90 per cent of it is wasted as heat. A compact fluorescent light bulb (CFL) in comparison uses 75 per cent less electricity.

The Sumatran tiger may become the first predator to join the extinct dinosaurs if Indonesia does not take drastic steps to control poaching for illegal trade. As of now, there are less than five hundred tigers in Sumatra.

On an average

- A leaky tap can waste about 12,400 litres of water in a year.
- You waste eleven litres of water a minute when you let the tap run while brushing your teeth.
- People use nineteen litres of water per minute when they take a shower.
- Every time you flush the toilet about eleven litres of water goes down the drain.

Harness the sun's energy!

Make your own solar oven

Grab those rays to cook up something. A solar oven uses the sun's energy to heat and cook food without giving out pollution and smoke. By using a solar oven, you can save precious fossil fuels too.

Heat it and eat it!

What you need

• A large empty pizza box • Black card paper • Aluminium foil (kitchen wrapping foil works too) • Clear plastic (heavy plastic laminate works best) • Non-toxic glue, tape, scissors, ruler, twig, and a pencil

Putting it together

1 Draw out an eleven-inch by eleven-inch square on the cover of the pizza box.

2 Cut out three sides of the square (leaving the back flap side uncut).

3 Lift the cut-out square and cover and tape the inside of the flap with aluminium foil.

4 Cut out the plastic a little larger than the square you have cut. Keeping the flap lifted, stretch the plastic tightly across the square opening and tape it to the sides of the box. This becomes the window. It needs to be tight so that no air can escape from inside the oven.

5 Open the lid of the pizza box. Cut out aluminium foil and completely cover the inside of the box with it. Glue it in place.

6 Cut out the black construction paper to fit the inside of the box. Place it on the aluminium foil and secure it with tape.

7 Close the lid and open the flap with a twig or a pencil. Face it towards the sun. Adjust the direction of the box so the flap can reflect maximum rays to the plastic window.

8 Warm up your muffins or cook apples and marshmallows by placing them on the window. Pick up your cooked food carefully after it is ready, as it will be very hot.

Glossary

Arboretum— a place where an extensive variety of woody plants are cultivated for scientific, educational, and ornamental purposes

Bacteria— living things seen only under a microscope, and found in rotting matter, air, soil, and living bodies, some being the germs of disease

Biosphere— the parts of the land, sea, and atmosphere in which organisms are able to live

Biodiversity— the variety of living things found in a certain region

Bon— good

Contaminate— pollute, make filthy

Carbon dioxide (CO_2)— a colourless, odourless gas that is found in small amounts; humans exhale it while plants absorb it to make their food

Critically endangered— species that are at an extremely high risk of becoming extinct

Ecosystem— a collection of living things and the environment in which they live

Erosion— the process by which the surface of the earth is worn away by the action of water, glaciers, winds, waves, and so on

Eurasia— Europe and Asia together as a continent

Food chain— a community of living things where each member is eaten in turn by another member

Fossil fuels— fuels such as oil, coal, and natural gas

Fungi— yeasts, moulds, and mushrooms

Germination— the process of sprouting from a seed into a plant

Habitat— the natural environment of an organism

Hibernation— a state in which animals like bears become inactive in winter months when food is hard to find

Permafrost— permanently frozen subsoil

Pedologist— a scientist who studies soil

Predator— an animal that lives by capturing and eating other animals

Phytoplankton— minute, free-floating aquatic plants

Pollutants— things that contaminate air, water or soil

Micro-organism— any organism too small to be seen without a microscope

Migratory— travelling from one place to another at regular times of year, often over long distances (salmon, whales, and swallows are all migratory animals)

Mineral— a natural substance like coal and oil

Near-threatened— animals whose numbers are small or becoming smaller

Nitrogen cycle— the circulation of nitrogen in nature

Nutrients— foods that give nourishment

Recycle— processing waste products or things that we no longer need into new, usable items

Reforest— to replant an area with trees

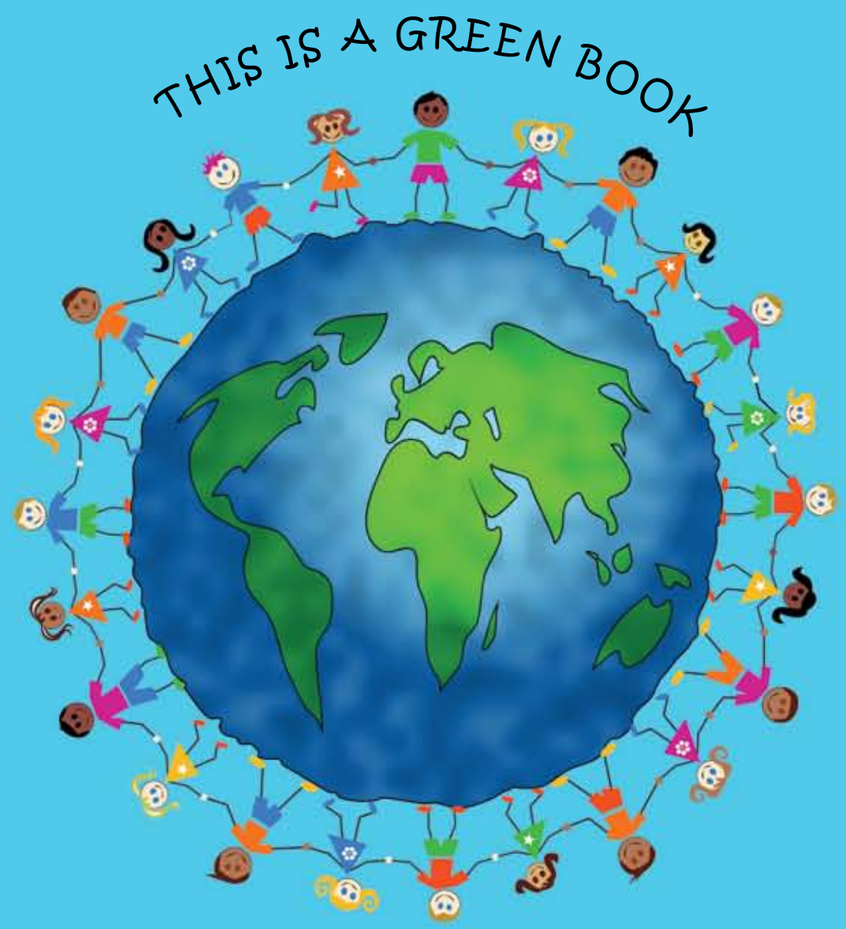
Silt— fine sand

Species— a group (of animals or plants) whose members are so similar or closely related as to be able to breed together

Toxic— having the effect of poison

Thrive— to grow well

Index



First published in 2008
Reprinted in 2009

TERI (The Energy and Resources Institute)
Darbari Seth Block, IHC Complex, Lodhi Road, New Delhi - 110 003, India
Tel. 2468 2100/4150 4900, Fax: 2468 2144/2468 2145
India +91 ▪ Delhi (0)11
Email: teripress@teri.res.in ▪ Website: http://bookstore.teriin.org

Adapted for UAE by Environment Agency, Abu Dhabi

ISBN 978-81-7993-143-1

Adaptation Material: Environment Agency, Abu Dhabi
Managing Editor: Madhu Singh Sirohi
Series Editor: Pallavi Sah
Art Direction and Concept: Priyabrata Roy Chowdhury
Illustration: Rajesh Das and Yatindra Kumar

PICTURE CREDITS
Nimbus Satellite, pp 8–9: NASA

Printed and bound in India

This book is printed on recycled paper

SAVE PLANET EARTH

FUTURE POWER

GREEN GADGET GUIDE

Author
Tanya Luther Agarwal

Terrapin

Note from Mr. Majid Al Mansouri

It is He, who made you trustees of the earth,
And exalted some in rank over others.
In order to try you
By what He has given you
Indeed your Lord's retribution is swift
Yet He is forgiving and kind.

Verse from Holy Quran –Surat Al Ana'am

Ayah 165 (6:165)

Climate change today is threatening our planet and in fact our very survival on earth .All countries and governments are concerned as we humans have contributed to this malaise. To find solution to any problem, we must first fully comprehend it. Hence Environment Agency – Abu Dhabi (EAD) in association with The Energy Research Institute (TERI) is adapting and bringing this save planet series of books on Climate change to children in the UAE with a hope that students as future custodians of our environment learn about what ails our mother earth, how each one us impact the environment through our actions, so that they are in a position to make appropriate decisions on matters that affect the health of our planet.

Climate change is expected to have direct and indirect impacts on earth. Scientists predict that we would lose nearly one third of our biodiversity, Sea levels would rise flooding low lying areas, face severe fresh water shortages , desertification , health issues such increased incidences of infectious diseases, heat strokes, forest fires, hurricanes and extreme and strange weather patterns to name some .

While governments are trying to fathom this new reality and looking at ways and means to tackle this global issue, it is becoming clearer to all, that only a concerted and collaborative action from each and everyone can actually help save this unique planet. United Arab Emirate too is aware of its responsibility and that is why despite being a country which is endowed with vast reserves of petroleum, a non renewable resource, and the one which contributes to climate change, it is working hard to establish the first carbon neutral city MASDAR in the coming few years and invest more on developing the renewable source of energy in the country. In addition, the country is also aiming to educate its future generation, through imbibing sound knowledge, imparting skill and helping to develop right attitude towards the environmental issues so as to prepare them to face any eventualities in the future.

We hope these books would be read by all students and would help them to understand the issue of climate change and the role that they can play in helping to save this unique planet.

CONTENTS

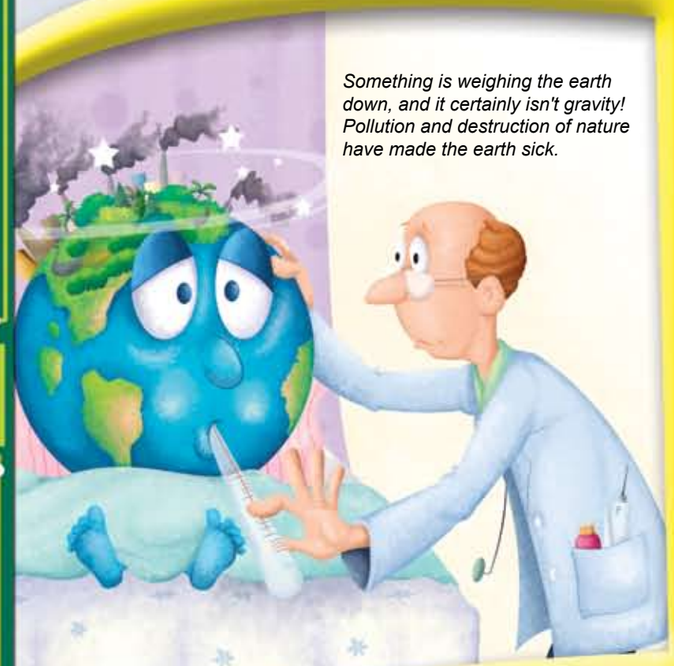
Squeaky Clean

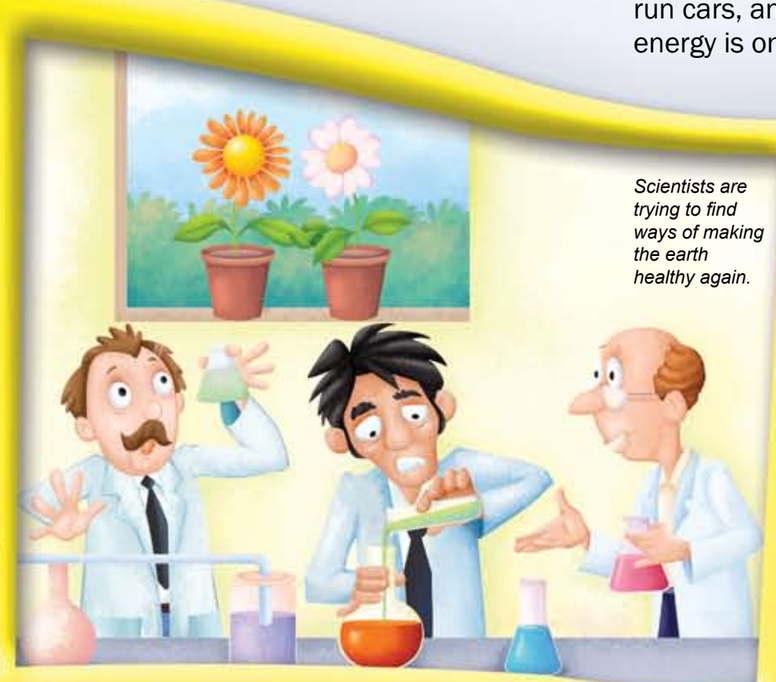
If you wanted to give a present to your friend or family, you would never dream of giving a stinking, dirty rag, would you? Environmentalists around the world wouldn't either. They have come up with ideas and technologies that will bring a smile to the 'face of the earth'.

Nature is green...

We haven't been good friends to the earth for a long time now. People around the world have polluted the air, rivers, and the land; cut down forests and left thousands of species homeless; and almost exhausted natural resources like fossil fuels that took millions of years to form.

Earth-friendly people use eco-friendly products. This is the first step towards being gentle and caring toward our planet. Environmentalists suggest that we use items that are handmade, free of chemicals or that have used up very little energy in their manufacturing. Recycled jute or cloth bags, handmade paper, and chemical-free soaps and detergents are some such items.



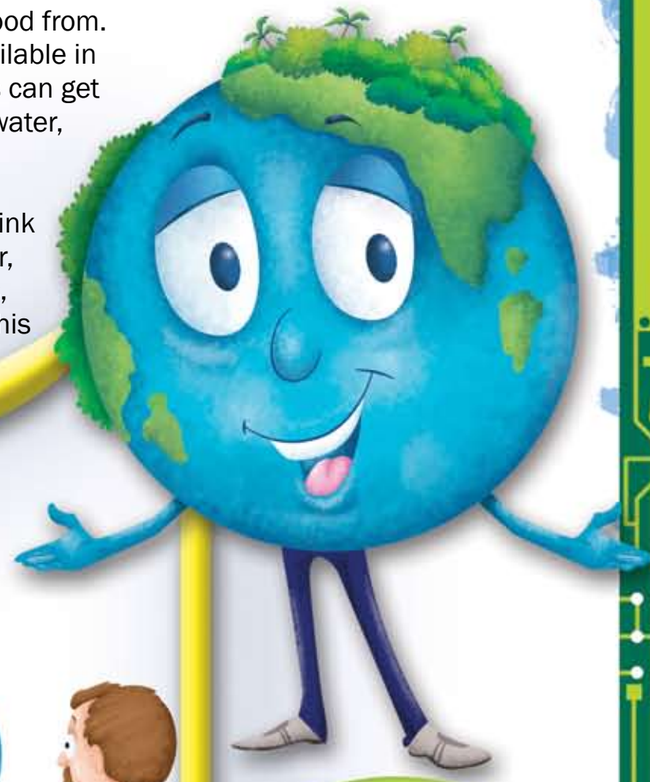


...And green is clean!

Take a look at the plants, trees, and birds around you. They don't have factories to buy food from. They feed and grow on whatever is available in nature—naturally! If these living beings can get all they need from the sun, wind, and water, then so can we.

Smart scientists, engineers, and inventors realized this and began to think about using energy from the sun, water, wind, and ocean tides to power homes, run cars, and fly airplanes. Capturing this energy is only half the battle; the other half is about working out ways to get this to the maximum number of people and in an inexpensive package.

Clean technology is the new buzzword for ideas that will help control global warming, cut down pollution and help heal our planet.



Greening the earth

Renewable energy experts in Europe believe that 50 per cent of the world's energy demand can be met by renewable sources by 2040 if governments take measures to develop and adopt green technologies.

Let the sun shine in

You can look up to it but you cannot look at it. It is the sun, of course! The powerful heat and light from the sun is called solar energy. This energy is converted, or changed, to produce heat and electricity in a form that can be used by people.

Follow the sun!

Humans have been worshipping the sun and using its energy for thousands of years. Without the sun there would be no life on earth.

The Greeks, Romans, Chinese, Native Americans and people of other ancient civilizations positioned their homes and baths to get warmth in the winter and shade in the summer. The Romans even knew how to grow vegetables in greenhouses in winter!

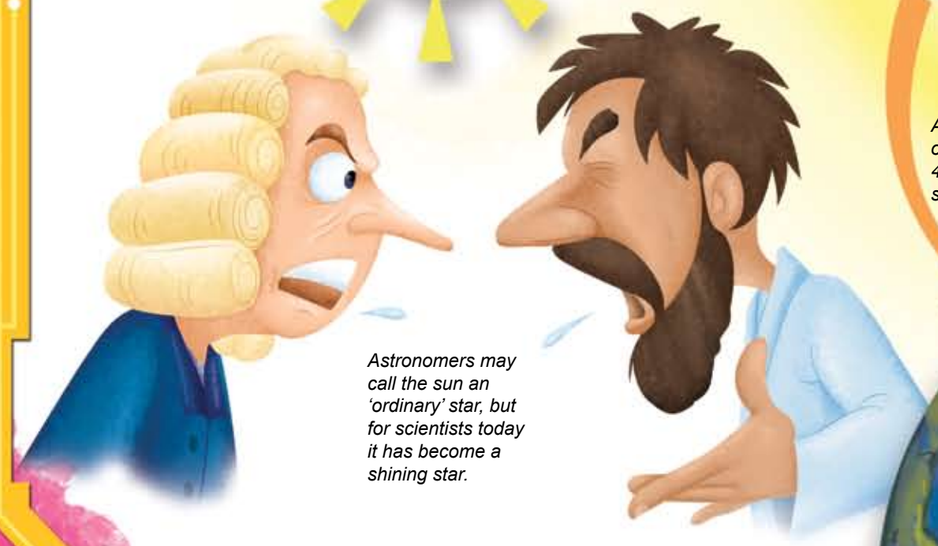
AD 1–500: *Roman baths were built facing south to have enough sunlight for heat*

7 BC: *Magnifying glass used to concentrate the sun's rays to make fire*

1767: *Swiss scientist Horace de Saussure invents the first solar collector*

1891: *Clarence Kemp patents design for the first solar water heater*

1964: *NASA launches the first solar-powered spacecraft*



Astronomers may call the sun an 'ordinary' star, but for scientists today it has become a shining star.

As of now, we capture only 1 per cent of this 4.6-billion-year-old star's power.

Not all of the sun's energy hitting the earth stays here. One-third of it reflects back into space.

It's got all we need

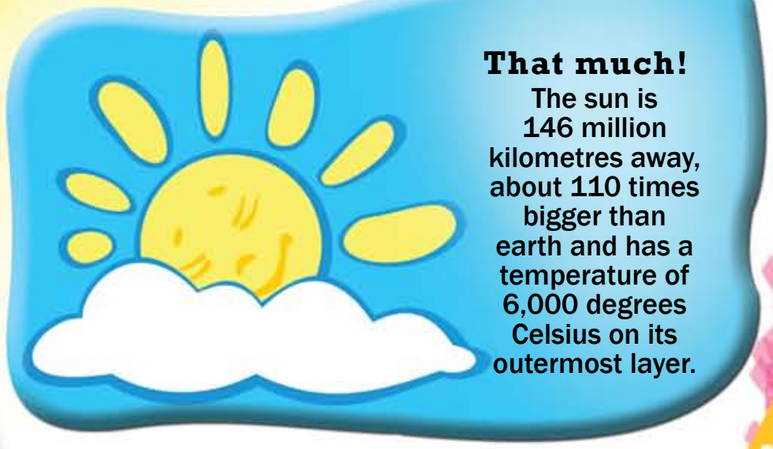
The heat and energy that we get on our planet from the sun in forty minutes is equal to the total energy used by all humans in the world in one year.

Two kinds of solar energy plants make electricity today. One uses solar photovoltaic panels that absorbs solar energy and converts it into electricity. The other uses concentrators - a device used to optimise the efficiency of solar power. Both of these, of course, depend on a sunny day!

Shades of yellow

Solar energy is safe for humans and the environment, and it is free. However, the equipment needed to convert the heat to energy is still expensive. Countries near the equator that receive a lot of sunlight can produce more solar energy than places near the poles.

Cloudy days and nights are times when solar energy cannot be harnessed and used. This can be taken care of by providing proper energy storage.



That much!

The sun is 146 million kilometres away, about 110 times bigger than earth and has a temperature of 6,000 degrees Celsius on its outermost layer.

The big thing: Solar cookers

In 1767, Swiss geologist and physicist Horace de Saussure cooked fruit in a glass box. Mountaineer Samuel Langley used a box cooker while scaling Mount Whitney in 1881. Simple, basic solar cookers are as popular as ever today, especially in developing countries.

Sun catchers

There are three basic solar cookers and hundreds of variations of these. The cooking time is longer, but since the food does not get overcooked there is no need to watch over the cooking.

The curved concentrators, or parabolics, need to be adjusted towards the sun as well as watched over. Burned food and fingers are very much a reality with these cookers!

Panel cookers are a combination of the box cooker and the parabolics. They are simple in design and inexpensive.

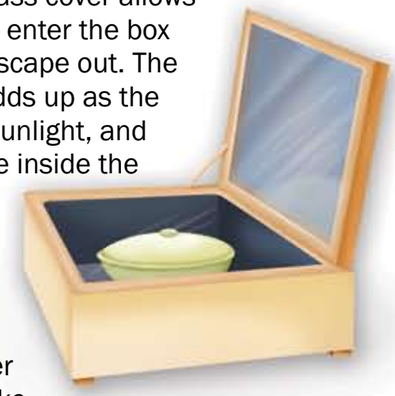
Panel cookers cook food faster than box cookers, but in smaller quantities. Sometimes, the food needs to be stirred for even heating.

Horace de Saussure observed that "a room, a carriage, or any other place is hotter when the rays of the sun pass through glass". This set him thinking about inventing a solar box cooker.

Parabolic cookers prepare food faster and at higher temperature. Large quantities of food can be cooked at a time.

How it works

Heat from the sun enters the solar box directly through the glass cover. Sunlight also bounces off the reflector into the box. Inside the box, the heat is absorbed, or soaked up, by the black paint on the cooking pot and base of the box. The glass cover allows heat to enter the box but not escape out. The trapped heat adds up as the box sits in the sunlight, and the temperature inside the box rises. This heat cooks the contents in the pot. Similarly the parabolic cooker uses material like aluminium which has a good heat retention value on its surface. Perhaps The best way to start building a parabolic solar oven is by using a ready-made satellite dish where the inside is coated with an aluminum sheet.



Box cookers cook food at medium to high temperatures and can hold two or more vessels.

Make custard while the sun shines

• 1 egg • 1 cup milk
• 2–3 tablespoons sugar
• ¼ teaspoon salt • ½ teaspoon vanilla

Mix all ingredients and place in a dark covered pot out in the sun. Bake it for one-and-a-half hours. Let it cool before serving.

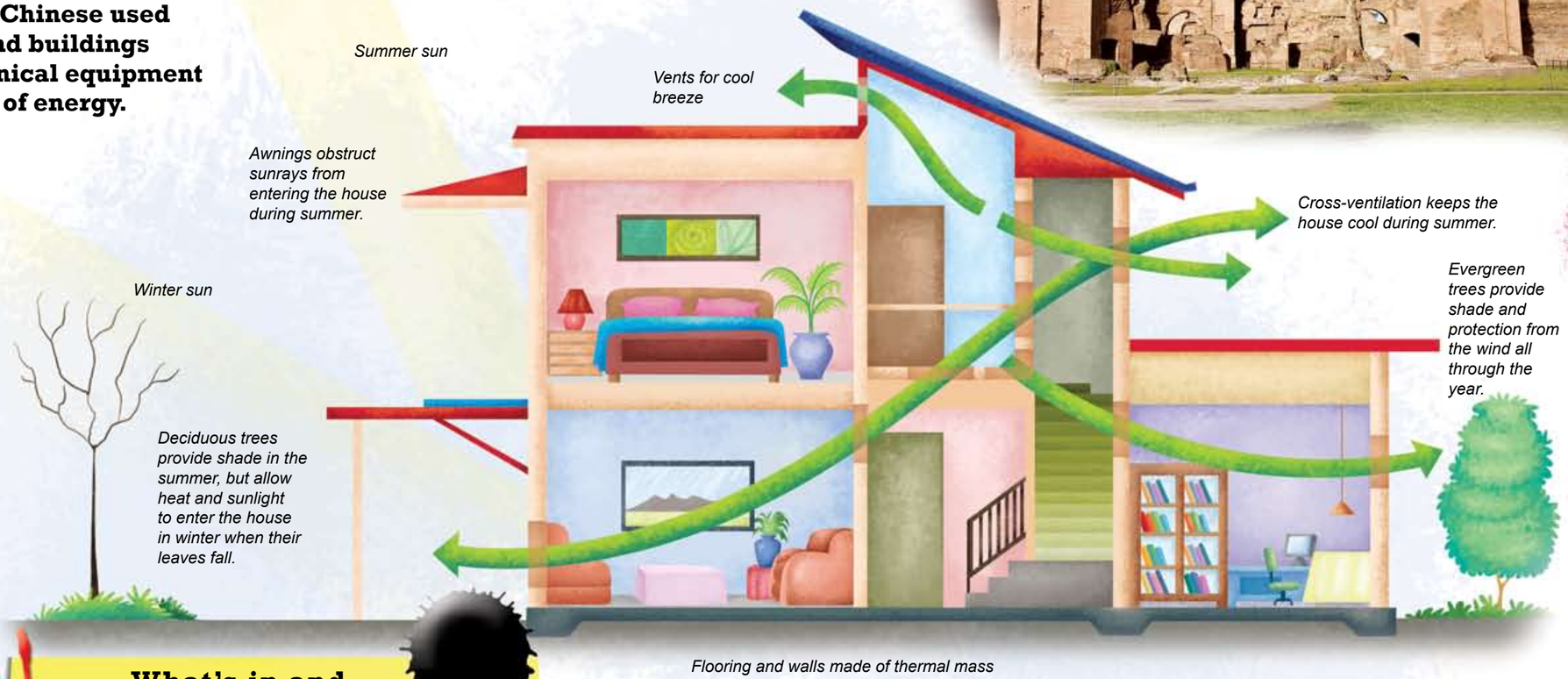
The other big thing: Passive solar homes

It may be called passive but it's actually full of energy. And, it's all about how much your house can face up to. The Greeks, Romans, and Chinese used intelligent designs for their homes and buildings without installing any kind of mechanical equipment or technology—making 'passive' use of energy.

The ancient cave dwellings in Mesa Verde, Colorado, received warmth from the winter sun but were shaded by the hill against the summer sun!

The Baths of Caracalla, dating back to the third century, had large south-facing windows

PASSIVE SOLAR HOME



Flooring and walls made of thermal mass

South it is!

A simple design can warm a house or cool it when needed. Places that have clear skies during winter months are the best spots for passive solar homes. Such homes typically have south-facing large windows, blinds, moveable awnings, bricks, and tiles and stones in their walls or floors. The idea is to capture the light, absorb the heat, and to allow the breeze in and circulate to balance the temperature of the house. Shady trees and landscaping are also important features of a passive solar home.

What's in and what's out

Eighty to 98 per cent of sunlight that hits white materials or objects reflects, or bounces off. Dark-coloured materials absorb 40–95 per cent of the sunlight that hits them. That is why wearing white clothing in the summer and dark clothing in the winter is a smart thing to do.

How it works

When sunlight enters a house through a window, it hits objects in the room. Some heat in the sunrays gets absorbed, or soaked up, by the thermal mass, made of bricks, concrete, plaster, stone, and furniture inside the house. Windows, floors, and walls collect, store, release, and spread out this heat. This heat is trapped and stored in the day during winter. In the evening, as the air cools outside, the trapped heat is slowly released by the thermal mass inside, and the house has a comfortable temperature. During summer, the thermal mass absorbs the warm air inside, cooling the house.

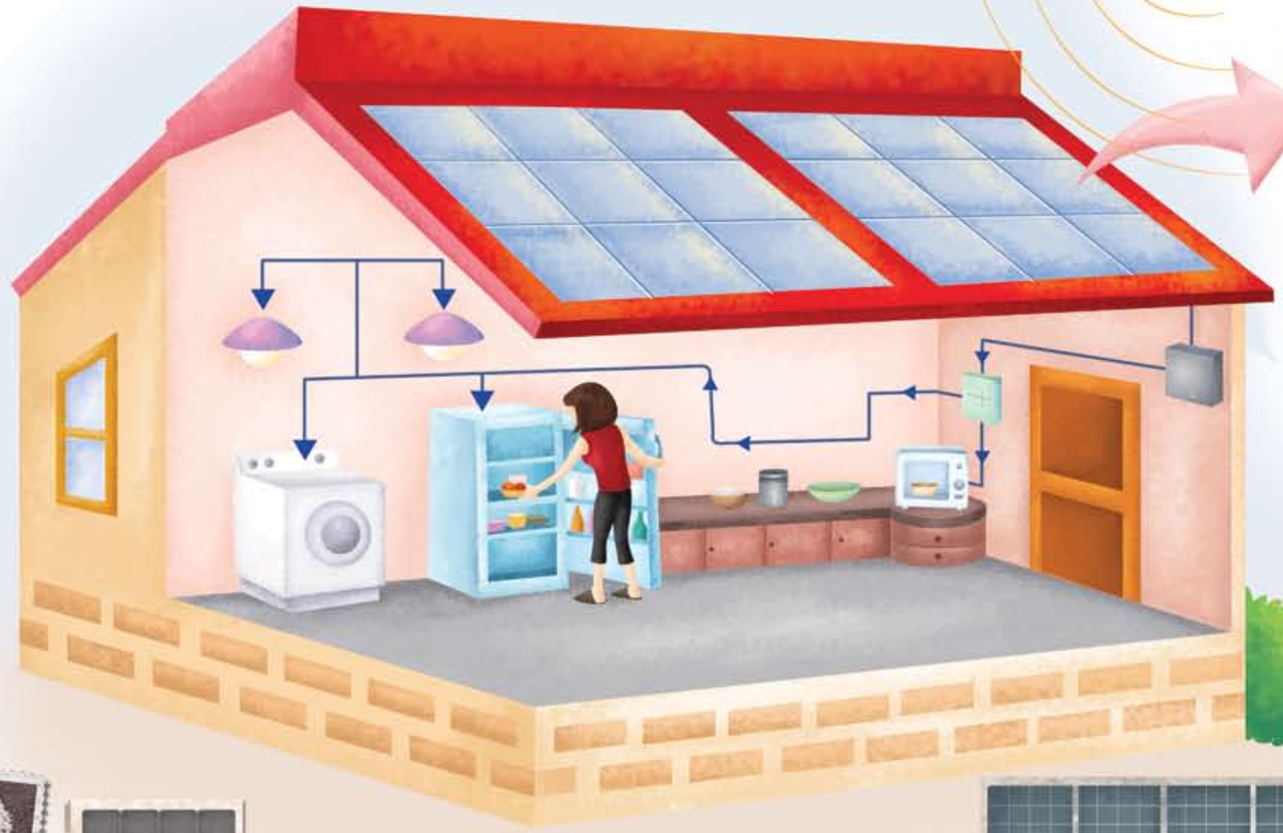
The in thing: PV cells

About fifty years ago, scientists developed cells or panels to turn sunlight into electricity. They called them photovoltaic or PV cells. 'Photo' means light and 'volta' means electricity. Together they bring sunshine into homes!

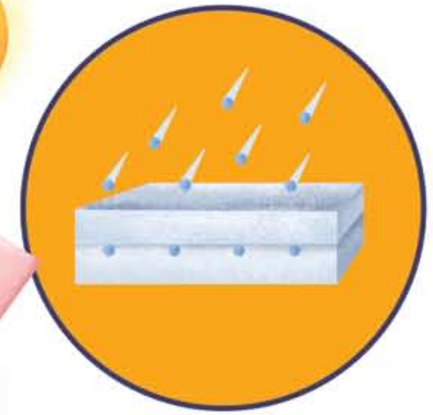
All charged up!

PV cells can be as small as half-an-inch to about four inches across. They are arranged on a panel to make a solar module. Depending on how much electricity needs to be produced, modules are linked to one another to make a solar array.

Although developed to power space satellites in the 1950s, PV cells have now found their way into people's homes. From calculators to wrist watches, PV cells are being used to capture solar energy to work household gadgets and to generate electricity.



When photons in the sunlight hit the solar cells, the energy created is absorbed by electrons.



When the energy is strong enough, the electrons become free and move around the panels as an electrical current, which can be used to run appliances!

How it works

Sunlight is made up of energy particles called photons. Solar cells are made up of silicon (melted sand), which has electrons in them. When photons in the sunlight hit the solar cells, they create energy. This energy is absorbed, or taken in, by the electrons.

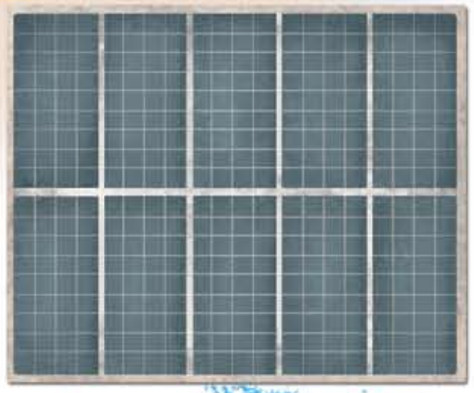
If the energy is strong enough, the electrons become free and loose and move around the panels as an electrical current. Each solar cell has a positive and a negative layer just like in a battery. The current in the electrons makes them move towards the positive and negative layers, and they carry an electrical current with them. This current moves through wires to a battery that stores the electricity. If homes produce more electricity than they need, owners can sell the surplus to the town network through the utility grid.

Genius in Spotlight

Although Albert Einstein is best known for his 'Theory of Relativity' he won the Nobel Prize in 1921 for his work on photovoltaics.

Solar module

PV cell



Solar array

The next big thing: Solar power

The promise of sunshine makes scientists think up of brilliant, bright projects for bettering our world.

Banish those bugs!

Remote villages around the world that do not have clean drinking water facilities now only need a bottle to make bottled water. Alberto Medo and Francisco Gomez Paz have designed a solar bottle that heats up enough to make the water inside it safe to drink. The solar bottle is transparent on one side to let the light in and dark on the other side to keep the heat in.

Coming soon

It's surely hot in a desert, but by 2011 it will be one of the hot spots of solar generation in the world. In the Mojave Desert, California, thousands of mirrors, called 'heliostats', will angle for a spot in the sun to produce 500 megawatts of clean energy that could possibly light up 3,75,000 homes in the state.

Solar energy promises a bright future!

Spray power

Want to go solar? No problem. Just spray it on. Or better still, print it and paste it. Researchers at the University of Toronto are working on a new spray-on solar technology that can be applied to any surface—clothing, roof of a car or building, boats, cell phones, and tents. Any surface can turn into a super solar power station. That's not all. Researchers are also hopeful that someday people will be able to print the solar panels from a simple inkjet home printer and paste it wherever they need it!

Blow the light on

A combination of two or more things is usually very interesting. This one is interesting and productive. Outside the Panasonic Centre in Tokyo stands an amazing streetlight that gets 100 per cent of its power from solar and wind power. The design is called 'Seagull'. During the day it collects solar energy through PV cells and stores it in a battery, and can be used to power devices. Currently, it is being used in streetlights in Tokyo.

Speedy light

It takes only about eight minutes for solar energy to travel from the sun to the earth.

Blowing in the wind

If you have ever stepped out on a windy day, you must have noticed how difficult it is to walk against the direction of the wind. The sheer power and force of the wind can knock an umbrella out of your hand. Storms with high winds can uproot houses, while gusty winds can even rattle an airplane.

Forecast: Windy

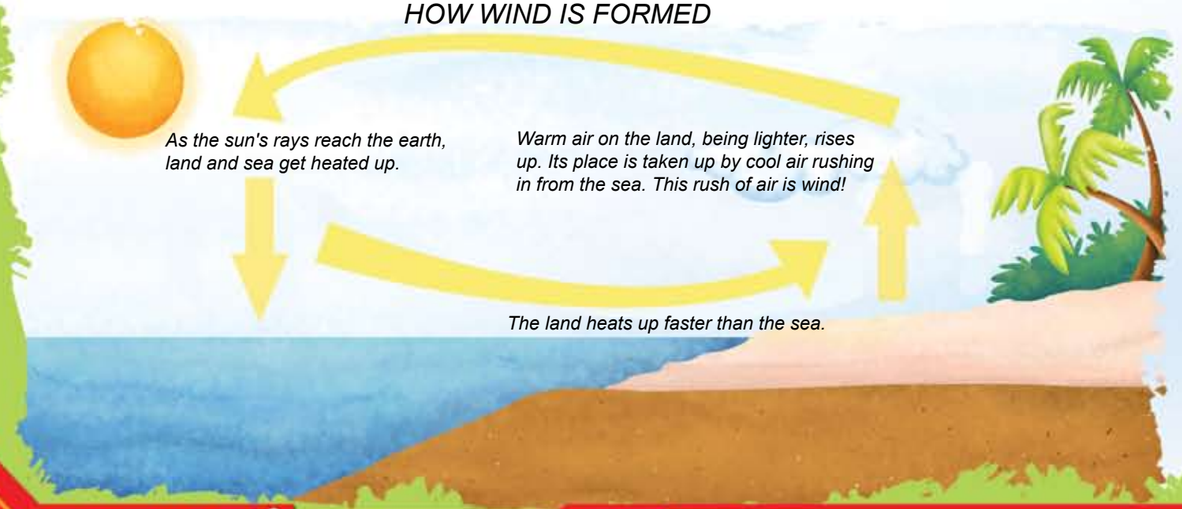
Air is everywhere around us, and when it moves, it creates wind. The sun heats the mountains, seas, hills, and the plains on the earth's surface. The land is not flat and even everywhere on the planet. So all places on earth warm up to different temperatures. When the earth's surface is warmed, hot air rises because it is lighter, and cool air takes its place. This movement causes wind to blow. Wind is measured by the speed with which it blows.

Why the wind?

Wind has power, force, and energy. From sailboats on the Nile in 5000 BC to windmills for pumping water in China, wind energy has also been used by people for various purposes down the ages. Today, wind turbines produce electricity.

Over 1.6 billion people across the world, or about a quarter of the world's population, face energy shortage. By the year 2050, people's energy demand around the world is expected to double from what it is today. To add to the problem, pollution from the use of fossil fuels and fumes from cars and industries are warming our planet. From now on, every country needs to think of not just providing energy to its people but also ensuring that the energy is clean and non-polluting. Wind energy promises to be just that!

HOW WIND IS FORMED



The good, the bad, and the ugly

Wind energy is clean, free, renewable, and non-polluting. However, turbines produce electricity only when the wind blows. Using wind energy does save and cut down the use of fossil fuels such as coal and petroleum, but the machinery and technology of wind turbines are slightly costly.

Some people see these machines as beautiful towers, while others find their sight unappealing. Birds crashing into the blades are worrisome to environmentalists. Whatever the opinion, wind turbines continue to move, and their technology only gets better with time.

Sir Bani Yas Island

The big thing: Windmills

The Persians were the first to use windmills way back in the seventh century to grind grain and to pump water from the ground for irrigation. In Europe, windmills were developed in the twelfth century, and in China, a century later. The first wind farm in the Middle East was built in the UAE, on Sir Bani Yas Island in August, 2004.

Wind catchers

There were three classic windmill designs that can be seen even today. Post mills were the earliest kind, used in Europe to grind cereals. The body of this mill was balanced on a large post so that the entire mill could rotate to catch the wind. The wide bottomed smock mills followed as an improvement. These were shaped like the dresses worn by farmers at the time, and made of wood. These six or eight sided mills were larger and only their roofs moved with the wind. Finally, the tower mills came with an even smarter design. Although the roof moved in the same way, the mill itself was made of brick or stone which made them fire proof and weather proof. The windmill is no longer what it used to be. Neither are the farms where they once stood. Modern day windmills are sleek in design, gigantic in size, and do a lot more than grind cereals!

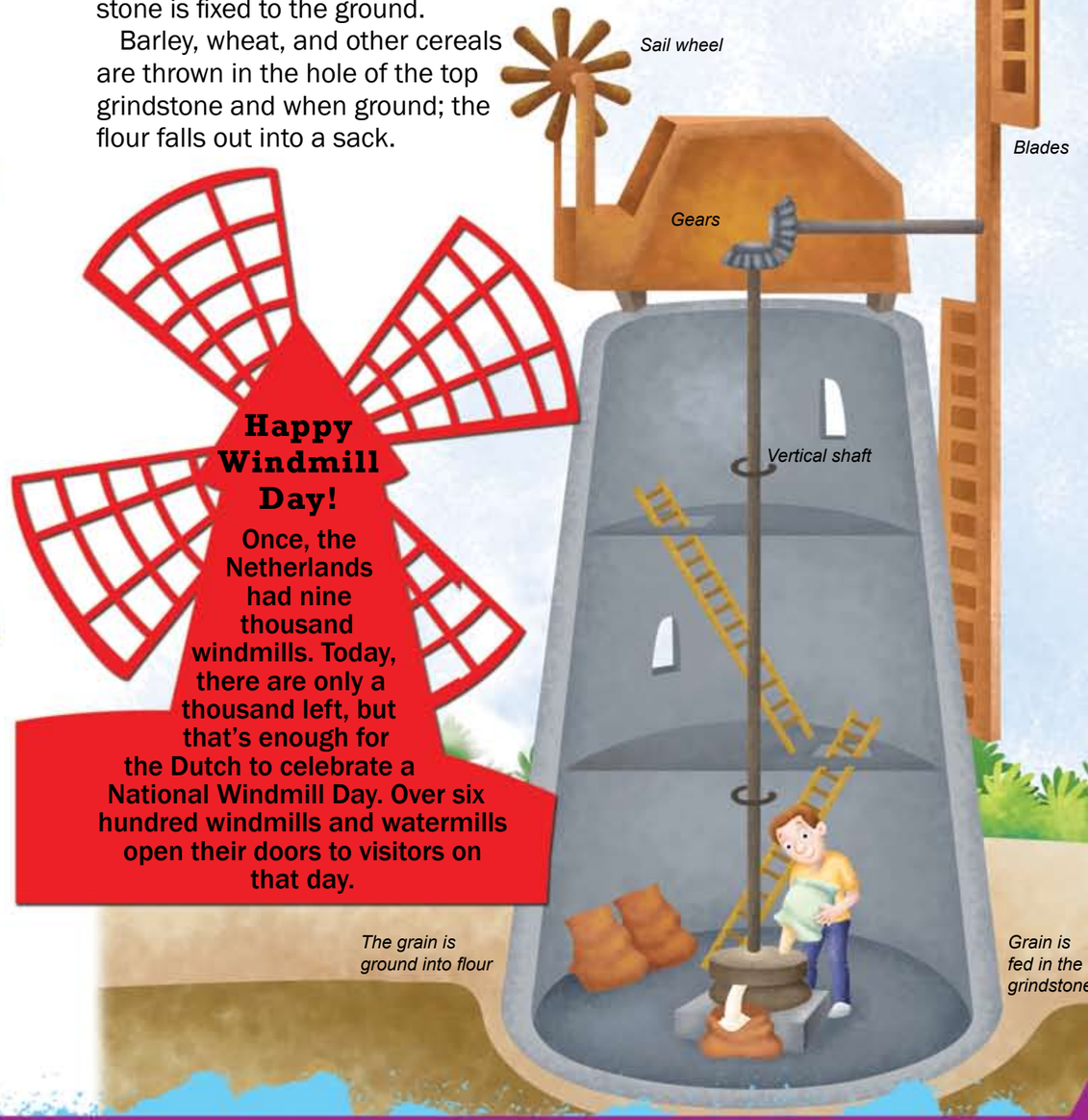
Smock windmill

Post windmill

Smock mill: How it works

When the wind blows, the blades rotate on a horizontal shaft. This horizontal shaft is connected to a gear system, which turns the vertical shaft. The small sail wheel also moves with the wind and it turns the top of the windmill and blades to face the wind. This makes the gears move, but vertically, or up and down. The vertical shaft is connected to a grinding stone. The moving gears rotate this shaft and the top half of the grinding stone. The bottom half of the grinding stone is fixed to the ground.

Barley, wheat, and other cereals are thrown in the hole of the top grindstone and when ground; the flour falls out into a sack.



Happy Windmill Day!

Once, the Netherlands had nine thousand windmills. Today, there are only a thousand left, but that's enough for the Dutch to celebrate a National Windmill Day. Over six hundred windmills and watermills open their doors to visitors on that day.

The in thing: Wind turbines

The single and two-blade turbines may save the cost of a blade or two but do not balance and perform as well.

From the twelfth century windmill to the nineteenth century wind turbine, it has been a seven-hundred-year-long journey. The first windmill for electricity production was set up in Cleveland, US, in 1888. As with all other technologies, wind turbines have become more sophisticated not just in their looks but also their power.

The three-blade turbines are the most popular design simply because they are the most efficient.

One, two or three?

There are wind turbines with just one blade, and then there are wind turbines with more than one blade.

Wind turbines stand on tall towers on land or in the sea, at least thirty metres or higher. One such turbine can light up 1,500 homes. Several wind turbines in a place are called wind farms that together produce enough electricity for thousands of homes.

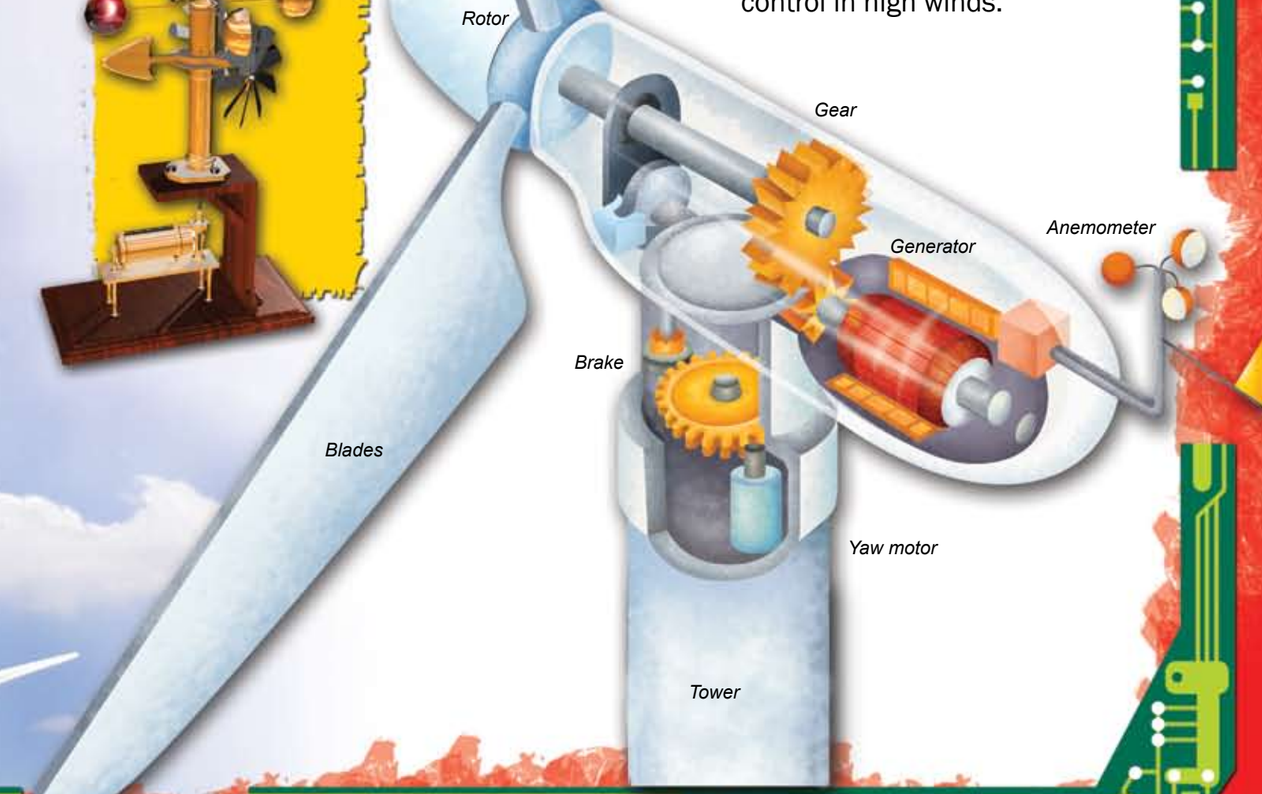
Anemometer

It is an instrument that measures the speed of wind.

How it works

The yaw motor automatically turns the turbine to face the wind. When wind blows, it passes through the blades and makes them spin. The propellers, or blades, are attached to a rotor. The rotor turns a shaft, which powers a generator. The generator changes the motion into electricity. Since the power or voltage of this electricity is weak, the generator gives it a boost so that the electricity can move through underground cables. These cables connect to electric substations and from there to homes.

As more air passes through the blades, more electricity is produced. The brake system stops the blades from spinning out of control in high winds.



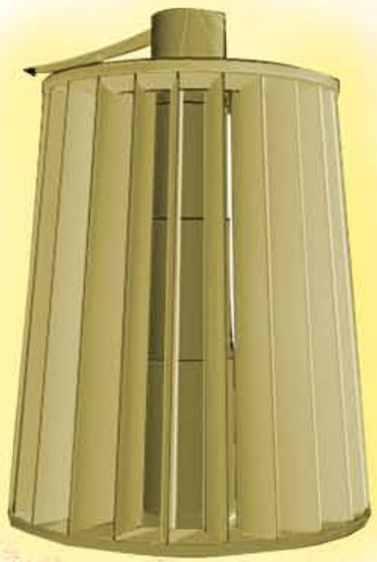
The next big thing: Wind power

The cost of wind energy has come down by 85 per cent in the last twenty years. The forecast: windy days ahead, as this resource is becoming the world's fastest growing energy and also the most affordable.

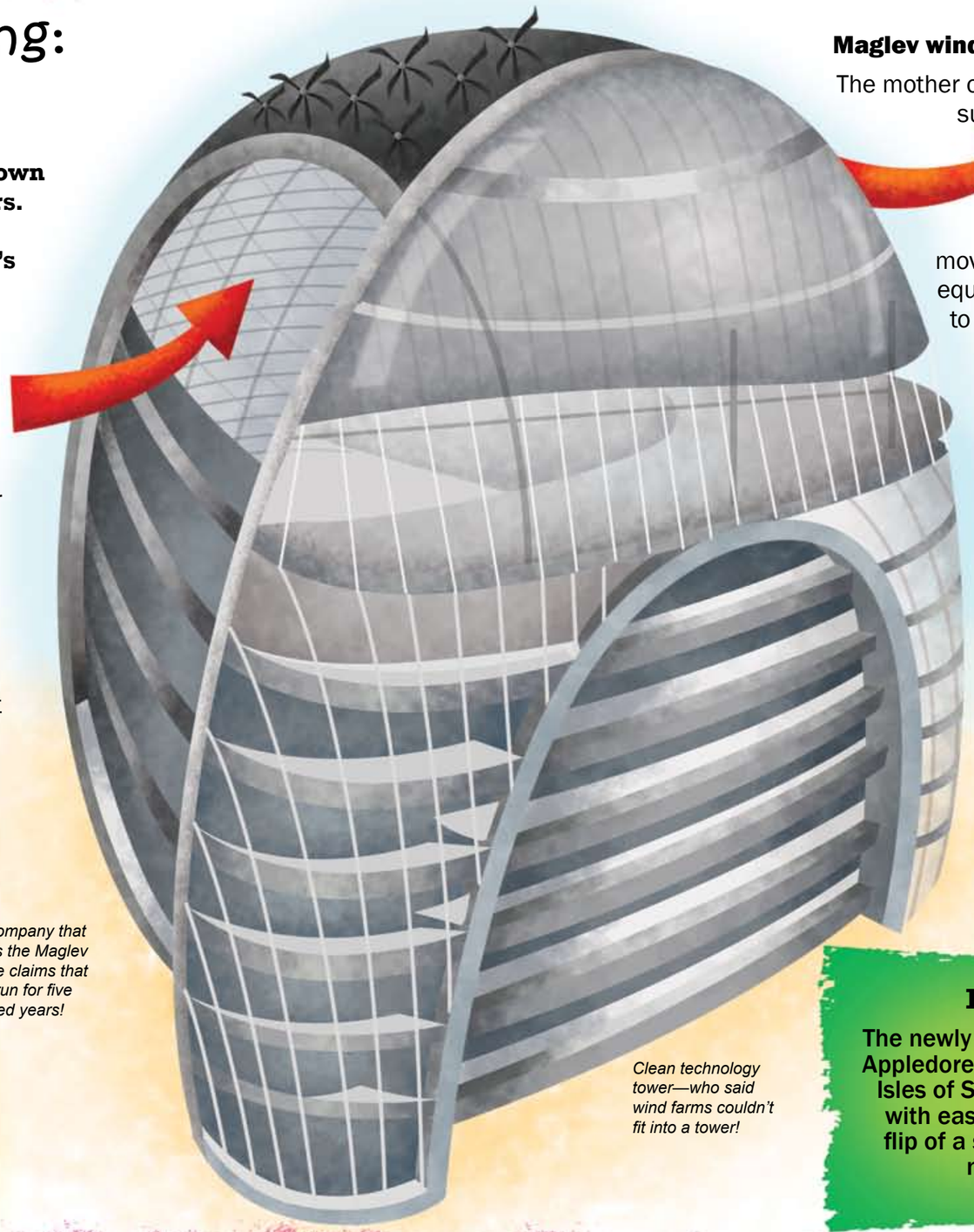
Win(d)–Win(d) situation

Germany is the leader in using wind energy for electricity. The country gets 10 per cent of its power from the wind. Although the US ranks second in the order of wind energy use, it needs to get more power from it. India ranks third in using wind energy, followed by the UK. Denmark produces 20 per cent of its power from wind energy.

As more countries join in, there's only good news 'in the wind' – a cleaner planet for us all!



The company that makes the Maglev turbine claims that it will run for five hundred years!



Clean technology tower—who said wind farms couldn't fit into a tower!

Maglev wind turbine

The mother of all wind turbines is the Maglev Wind Turbine. This superpower structure is made in Arizona, US, and will finally stand tall in central China at a whopping cost of fifty-three million dollars!

Magnetic levitation is a technology that uses enormous electromagnets to float and move the blades of the turbine. One such turbine is equal to 1,000 standard wind turbines and is expected to power 750,000 homes.

Clean technology tower

This tower will be different. It is not the architecture or the establishments in it that will make it different. It is the built-in wind turbines at the corners of the tower that will make it a highly energy-efficient building.

Architects Adrian Smith and Gordon Gill have designed this building for the city of Chicago, US. The idea is to capture the wind at the highest speed, especially on top of the tower, which will have a dome with a large opening for the wind to enter. The dome is to be layered with solar panels to capture solar energy. All that wind, which would otherwise simply blow away, will be used to cool the inside of the tower.

It's a breeze

The newly installed wind turbine at Appledore – the largest of the nine Isles of Shoals – can be lowered with ease by one person at the flip of a switch, staying clear of migrating birds.

What-a-power! Hydro energy

Still, trickling, flowing or gushing—water has more than just thirst-quenching ability. It is produced quietly by nature and sustains all life on the earth. Moving water has enough energy to power equipment—from small water mills to larger-than-life hydropower plants.

Water goes around comes around

It is nature's way of making sure that there is plenty of water for all living things on the earth. The sun's rays warm water in rivers, lakes, and oceans. It evaporates and rises into the sky as water vapour, which cools and forms clouds. When the air cannot hold any more droplets, the clouds release them as rain or snow, which fall on land and water bodies. This water cycle gives our planet the water it needs.

The moment water moves in rivers and waterfalls or even in oceans, its stored energy, or potential energy, turns into kinetic, or motion, energy that can be tapped and turned into electricity or into useful mechanical power. That is hydropower, or the power of water!

From olden days to new ways

In ancient times, water wheels made from wood stood where a steady flow of water fell from a height. These water wheels had paddles that turned with the force of water grinding corn and hulling rice. Over the centuries, water wheels were used for iron casting, paper making, and rock crushing and mining.

By the early 1800s, the water wheel was modified into a water turbine, and in the later 1800s, into a generator. The hydro turbine was developed in the nineteenth century to move industrial machines, and today small and large versions of it produce electricity for single homes as well as large communities.

Liquid energy

Hydro energy can also be created with turbines from water in a dam, and waves (tidal energy) in the ocean. Water power is clean energy and more reliable than solar or wind energy simply because water can be stored, unlike wind or sunshine. Although the power stations are expensive to build, they are inexpensive to run. The US is the largest producer of hydropower in the world, followed by Canada.

Coal facts
Hydropower prevents the burning of 120 million tonnes of coal each year.

THE GREEKS, ROMANS, AND EGYPTIANS USED WATER WHEELS AS FAR BACK AS 500 BC.

THE CHINESE HAD DEVELOPED WATER WHEELS TO PERFORM VARIOUS DIFFERENT TASKS BY AD 1.

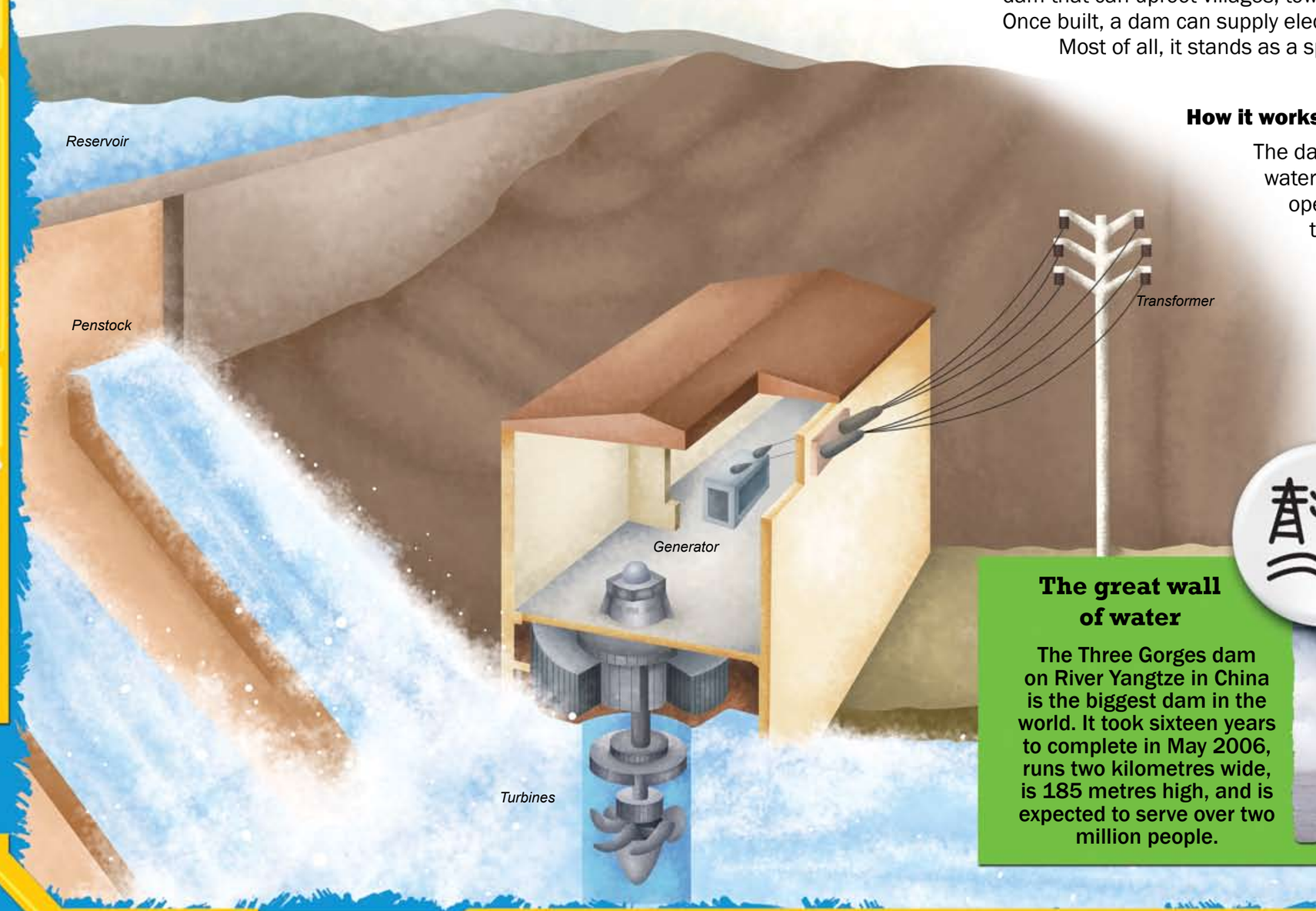
BY THE 1800s, WATER WHEELS HAD BEEN MODIFIED INTO TURBINES.

IN THE LATE 1800s, THE FIRST HYDROELECTRIC DAM WAS BUILT.

The big thing: Hydroelectric dams

Take water, let it flow and make electricity. Of course, in reality it isn't that simple, but the idea behind a hydroelectric dam is.

HYDROELECTRIC PLANT



Tall, wide, and electric!

The most common method of producing hydro energy, and large amounts of it, is by getting it from a hydroelectric dam. Today, hydroelectric power makes up 20 per cent of the world's electricity. Norway gets 99 per cent of its electricity from water, while New Zealand, 75 per cent.

If a dam can light up many homes, it can also displace and destroy several others. Although the technology itself is a clean one, it is the construction and location of the dam that can uproot villages, towns, forests, and the species that live there. Once built, a dam can supply electricity on demand and jobs to hundreds of people.

Most of all, it stands as a spectacular and imposing feat of engineering!

How it works

The dam acts as a blockade and traps and holds back the water in a reservoir. Gates on large tunnels, or penstock, open and allow gushing water to flow through to a turbine(s). The high pressure in the water pushes against the blades of the turbine and makes them turn. The turbine is connected to a generator. As the turbine spins, it moves the generator, which produces electricity. A transformer converts the current to a usable level. Transmission lines carry the electrical current from the hydroelectric power plant to substations, which then distribute electricity to homes, schools, and offices.

The flow of water is easily controlled and is increased or decreased depending on requirement. The same quantity of water that flows out of the reservoir is steered back into the reservoir without being polluted.

The great wall of water

The Three Gorges dam on River Yangtze in China is the biggest dam in the world. It took sixteen years to complete in May 2006, runs two kilometres wide, is 185 metres high, and is expected to serve over two million people.

The next big thing: Hydropower

For some it may be just a glass of water, but for smart minds out there, water can power the future.

Turbo toilet

Those long hours spent in the toilet by so many people could actually be justified and generate some good—electricity! A gadget called Benkatine Turbine, which can be attached to the flushing mechanism of a toilet, produces electricity when the toilet is flushed.

The turbine works in the same way as it does in a hydroelectric dam. When the flush is pulled, the turbine rotates and makes electricity. The makers of this device claim that the turbine can produce energy in any pipe that has water flow in it, including sewers and gutter drains.

The Benkatine Turbine produces electricity every time the toilet is flushed!

When time just flows by...

It's a clock and a thirsty one at that. This clock starts ticking moments after it is filled with water and works by allowing current to pass through it. It can run for weeks without a refill. Some brands now offer an alarm, countdown timer, and thermometer—all watered in with the clock!

Water-powered calculators run just as well as water clocks. Just one cap full of tap water can run a twelve-digit, full-function calculator for months.

Water...ring, ring!

If cell phones were one of the greatest inventions of the last century, then water-powered cell phones will be in the next decade. Electronic giant Samsung has developed a cell phone that will work on a water-powered cartridge in place of a regular battery. A hydrogen fuel cell that will hold the water will need to be charged every fifth day, but the company is working towards not having to charge the cartridge at all! The first such phones are expected to hit the stores in 2010.

Simple alternatives such as the water clock and water calculator can keep thousands of toxic batteries out of landfills.

Does time just flow with the water clock?!

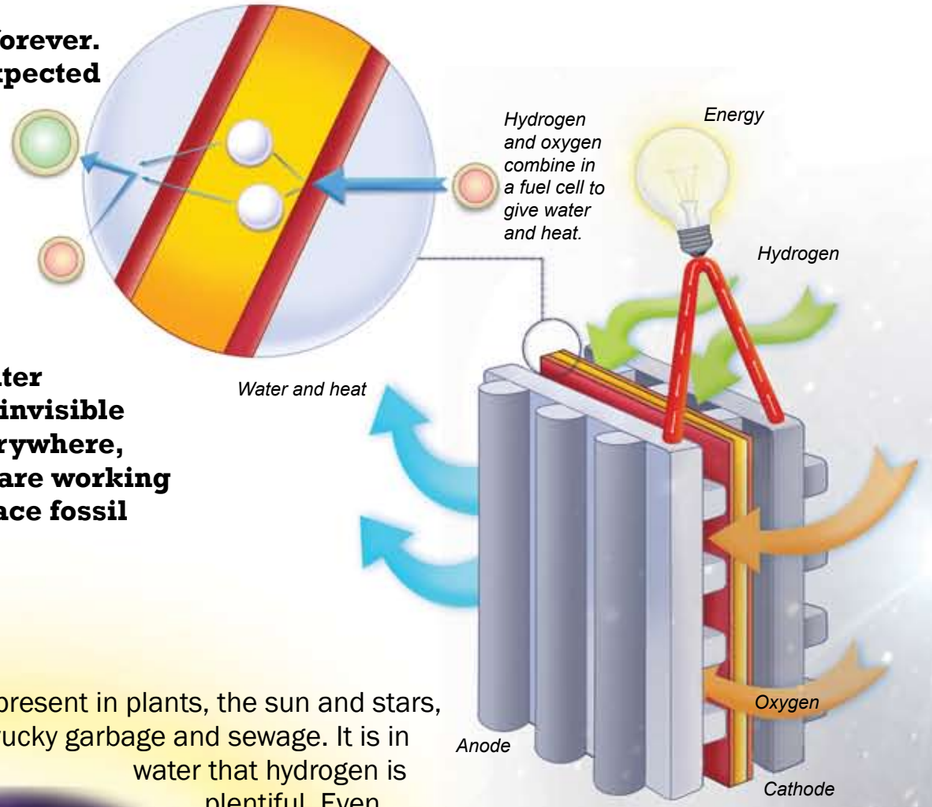
Soon, you could be charging your cell phone with water!

Into thin air?

Each day, the sun evaporates one trillion tonnes of water.

All that gas! Hydrogen energy

Nothing lasts forever. The earth is expected to run out of oil and gas reserves in forty to seventy years, unless more places that have them are discovered. Enter hydrogen—an invisible gas that is everywhere, and scientists are working on how to replace fossil fuels with it.



The power of H

Hydrogen gas is present in plants, the sun and stars, and even in the yucky garbage and sewage. It is in water that hydrogen is plentiful. Even so, hydrogen is always found in combination with other elements and never by itself. To get hydrogen alone, it has to be produced by industries. Hydrogen can be converted into usable energy through fuel cells and by burning it through turbines. Hydrogen can power vehicles and produce electricity without giving out any pollution.

Hydrogen gas is high on energy

All charged up!

A fuel cell is a battery like device that converts chemical energy into electrical energy. In a fuel cell, hydrogen combines with oxygen to produce electricity. While fossil fuels release polluting gases when burned, hydrogen fuel cells give out only heat and water. There will be more hydrogen in our homes, transportation, and electronics as scientists work on how to store and carry hydrogen to near and far facilities.

Ten hydrogen fuel cell buses will be plying in London by 2010.

High on hydrogen

Auto makers like Honda, Peugeot, Toyota, and General Motors have given to the world hydrogen fuel cell cars. For all those extreme bumper-to-bumper traffic days, there are also buses, trucks, and scooters that can give their eco-friendly owners 'green' peace of mind. Boeing has already tested the first manned fuel cell flight in a two-seat glider to prove that hydrogen can go higher.

New green car

The 'LifeCar', the world's first pollution-free sports car, was unveiled at the Geneva Motor Show 2008. The car is powered by a fuel cell, and the only bi product is harmless water vapour.

Nature's bounty: Bioenergy

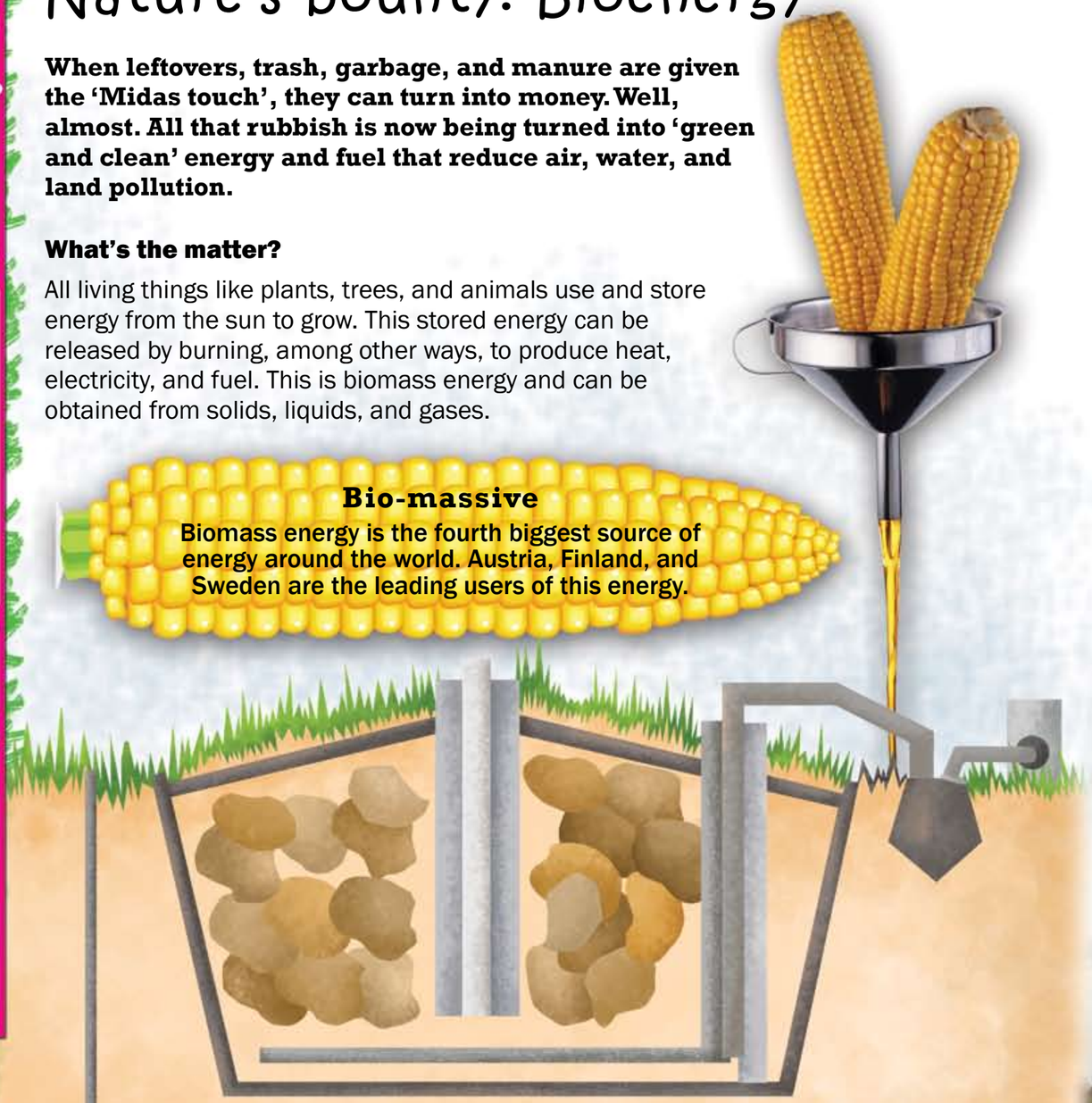
When leftovers, trash, garbage, and manure are given the 'Midas touch', they can turn into money. Well, almost. All that rubbish is now being turned into 'green and clean' energy and fuel that reduce air, water, and land pollution.

What's the matter?

All living things like plants, trees, and animals use and store energy from the sun to grow. This stored energy can be released by burning, among other ways, to produce heat, electricity, and fuel. This is biomass energy and can be obtained from solids, liquids, and gases.

Bio-massive

Biomass energy is the fourth biggest source of energy around the world. Austria, Finland, and Sweden are the leading users of this energy.



Trash is fast becoming a source of renewable energy. Garbage in landfills gives out methane gas. Pipes collect the gas; chambers process it into usable energy; and the supply is carried to power homes and industries.

Trash to treasure

Wood chips, logs, fruit pits, agricultural waste, seaweed, dead trees, sawdust, used tyres, and cow dung are processed to generate energy or heat. This heat is used to turn turbines to make electricity.

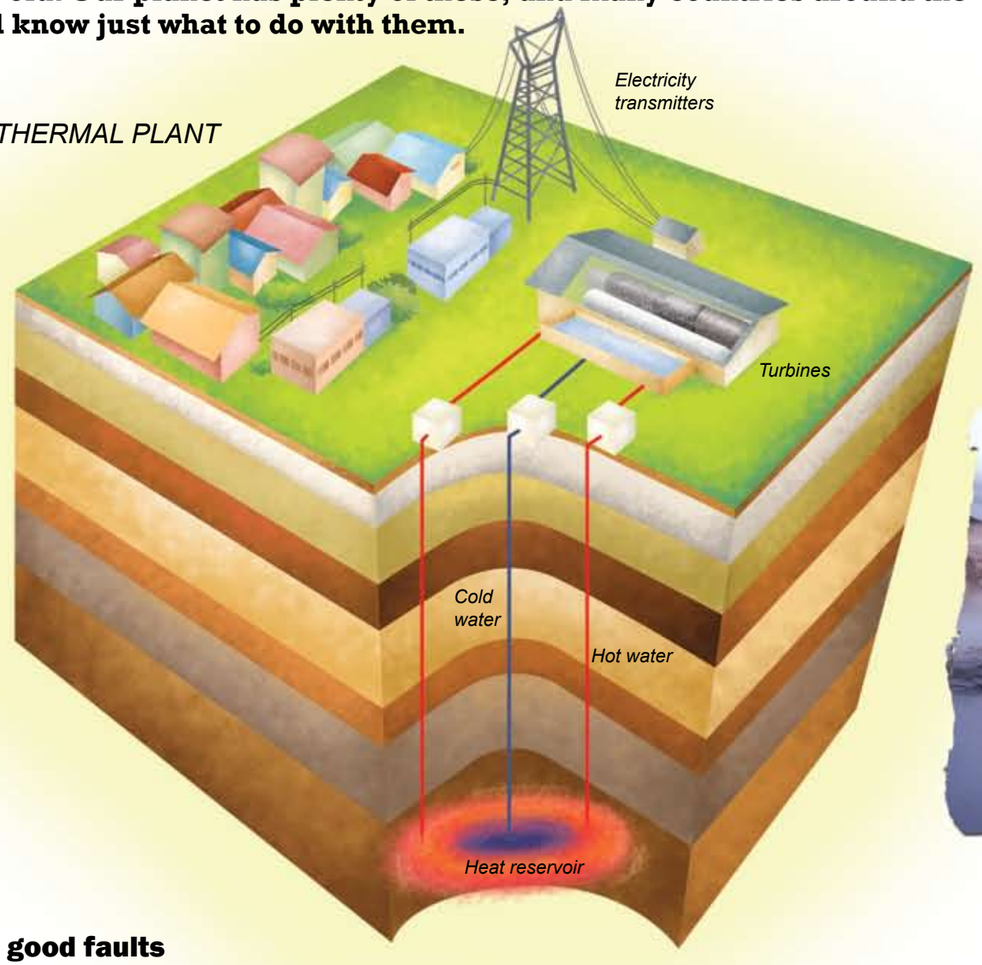
Juicy sugar canes, healthy soyabean, and crunchy corn are being grown not just for our meals but also as fuel for cars and vehicles. This fuel not just works out to be cheaper than conventional fuel but is also greener because it emits lesser greenhouse gases. Your physician may shudder at the thought of greasy oils in your food but leftover cooking grease and vegetable oils can now be used directly in diesel engines of vehicles. When these oils are heated, their thickness is reduced, and can be used directly in a diesel engine, or they can be chemically processed to produce fuels such as biodiesel. Wood and its byproducts can also be converted into biofuels.

From kitchen wastes to sugar cane, scientists are trying to find more ways to produce energy from nature.

Biomass gasifiers are widely used, especially in villages in India. The biogas that is produced can power machines and generate electricity.

Spring it on: Geothermal energy

Dust and gas can hardly interest anyone, more so if they are four billion years old. Our planet has plenty of these, and many countries around the world know just what to do with them.



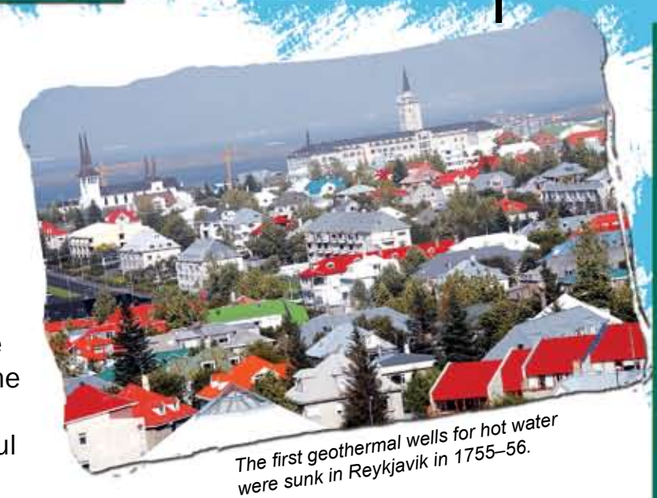
Some good faults

Deep in the earth's core, dust and gas sizzle at 4,982 degree Celsius and continuously push their way up to the surface. Steam and hot water at temperatures over three hundred degree Celsius burst out through cracks and faults in the earth as hot springs or geysers. This power from the earth is called geothermal energy.

The Romans used water from hot springs and geysers to treat skin disorders as well as to heat their buildings. Native Americans and New Zealanders have eaten hot meals cooked on hot springs for thousands of years. The Japanese have been relaxing in these hot waters for just as long now.

Dig the power!

Geothermal energy is not just about dipping and relaxing in all that hot water. It is also about lighting up homes. The most widely used process to generate electricity is by drilling wells about three kilometres deep down into hard rocks. Under these rocks is the geothermal reservoir. Pipes reach the underground reservoir and suck up steam or hot water, which is powerful enough to spin turbines that move generators to make electricity. If hot water is used, it is returned to the earth to be heated again, naturally!



The first geothermal wells for hot water were sunk in Reykjavik in 1755–56.

Smoke rising from a geothermal spring.

Blow hot, blow cold

When you think of Iceland, you would hardly imagine anything warm. But the city of Reykjavik has many buildings and pools heated directly from geothermal steam or hot water. Many northern latitude countries use the energy under roads and pavements to melt winter ice.

Like wind and solar energy, geothermal energy is clean, but it scores over both as it is available throughout the day and night and in all seasons.

Top ten users and makers

Geothermal energy is produced in over twenty countries around the world. The bigwigs are Iceland, US, Philippines, Italy, Germany, France, Indonesia, Mexico, New Zealand, and Japan.

City of joy

Earth lovers have imagined such a place for a long time now—a city that uses the earth's resources intelligently and keeps the planet healthy, clean, and green. In 2009, Masdar, in the United Arab Emirates, will become the first city in the world to take care of all its energy, food, and living needs using clean, eco-friendly technologies.

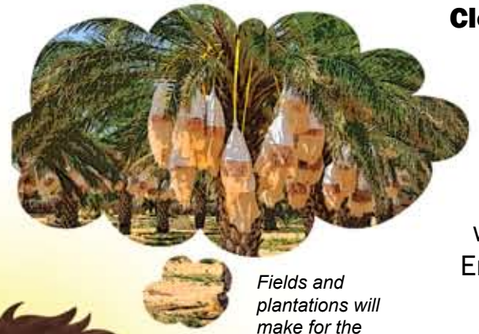
Electric public transportation will be used, with zero carbon emissions vehicles.

0 carbon + 0 waste = Masdar

Masdar will be a compact city spread over six square kilometres and home to researchers, scientists, students, policy-makers, and professionals from around the world. The government of Abu Dhabi, World Wide Fund for Nature (WWF), BioRegional's One Planet Living programme, and architects Foster and Partners have come together to build a zero-carbon and waste-free city. The Masdar Institute of Technology will open its doors to students in 2009, while the city is built over the next ten years. Once complete, over 45,000 people will live there while 60,500 people will come in as daily visitors.

Solar and wind power will produce 100 per cent of the city's energy for heating and cooling.

Masdar will be every earth lover's dream come true.



Fields and plantations will make for the perfect research grounds for scientists and also grow plants for biofuels.

Close to nature

Masdar's stone and mud walls and building rooftops will be fitted with photovoltaic panel to capture solar energy. Ninety-nine per cent of waste, which would otherwise find its way to a landfill, will be recycled, composted, and reused. Energy will be generated from waste. All building materials like wood, sand, and bamboo will be eco-friendly. Shaded walkways and compact streets will make walking outdoors cooler and convenient. All transport connections will be within two hundred metres from any point in the city. Masdar will be a car-free city. A light railway system will connect the city to Abu Dhabi. Driverless cars will transport a maximum of four people at a time on tracks below street level. All wildlife and their habitats will be protected.

Organic food available in food stores and restaurants will be grown outside the city and watered by recycled waste water from the city.

To the source

'Masdar' in Arabic means 'the source.'

Did you know?

Electricity travels at the speed of 299,338 kilometres per second. If there were a light switch on the moon for a lamp on the earth, it would take only 1.28 seconds to light up the lamp!

The world's greenest countries that have the lowest pollution levels, highest water purity, and best conservation efforts are:

1. Switzerland
2. Sweden
3. Norway
4. Finland
5. Costa Rica
6. Austria
7. New Zealand
8. Latvia
9. Colombia
10. France

About two billion people in the world live without electricity.

It's not just in restaurants that there is a charge for fish. Electric eels are highly charged invertebrates that can produce enough current to light twelve household lamps.

Photovoltaic cells are made with silicon which comes from sand. One tonne of silicon generates as much electricity as 500,000 tonnes of coal. Those golden sandy beaches are sure to look 'green' when you see them next.

An average wind speed of twenty-two kilometres per hour is all that is needed to turn wind into electricity – that is slightly faster than a squirrel can run!

Make your own solar water purifier

More than one billion people around the world do not have clean water to drink, and almost three million children die of disease caused by drinking polluted water. A simple setting in the sun can wash away those germs and give you safe drinking water at no extra cost. It can also desalinate salt water.

You need:


Large clear bowl


Salt


Drinking water


Empty glass

Cling wrap or clear plastic food covering

Small rock or pebble

Spoon to stir

Putting it together:

1 Pour water in the bowl. Add salt and mix well.

2 Place the empty glass in the centre of the bowl.

3 Cover the bowl with the cling wrap loosely so that it caves in a little bit. Press it down on the sides of the bowl so it sticks. (Hint: Use cello tape to stick cling wrap to the sides of the bowl if needed.)

4 Place the pebble on the cling wrap and directly above the glass.

5 Keep the bowl out in the sun.

6

The heat of the sun is absorbed by the water. The plastic covering keeps the heat trapped inside. The heated water begins to evaporate and turns into water vapour, which rises. When the water vapour reaches the plastic, it condenses and turns back into water. The sloping plastic guides the water drops to the centre, below the pebble and just above the glass. The water drips down into the glass. Clear and clean water becomes ready to drink.

Glossary

Biofuel— fuel that is obtained from plants and other living matter

Biomass— plant material, vegetation or agricultural waste used as a fuel or energy source

Compost— mixture of rotting matter that is added to soil as fertilizer for plants

Energy— power to do work

Fuel cell— device that turns hydrogen into fuel

Fossil fuel— coal, petroleum, and natural gas, which are dug out from the earth and used as fuel

Global warming— increase in the earth's average temperature

Geothermal— relating to the heat inside the earth; 'geo' means 'earth' and 'therme' means 'heat'.

Geyser— hot spring that throws out water at intervals

Horizontal— flat or level

Hydroelectric energy— energy that is obtained from water, usually by building a dam over a river

Hydrogen— a colourless gas that is present in water in combination with oxygen. The chemical symbol for hydrogen is H.

Hydropower— energy produced by moving water

Insulation— a material that reduces or prevents the transmission of heat or sound or electricity

Invertebrate— animals that do not have a backbone

Megawatt— a unit of power equal to one million watts

Organic food— food grown without the use of fertilizers

Passive solar energy— making use of sunlight, without using any equipment to convert it into energy

Renewable energy— energy produced from a source that is inexhaustible, or does not run out. For example, solar energy, wind energy, and so on.

Reservoir— natural or artificial place where water is collected and stored for use

Resource— source of supply

Rotor— rotating part of an engine

Technology— application of a skill or knowledge

Thermal mass— material within a house, such as concrete or brick, which absorbs and holds heat and reduces energy costs

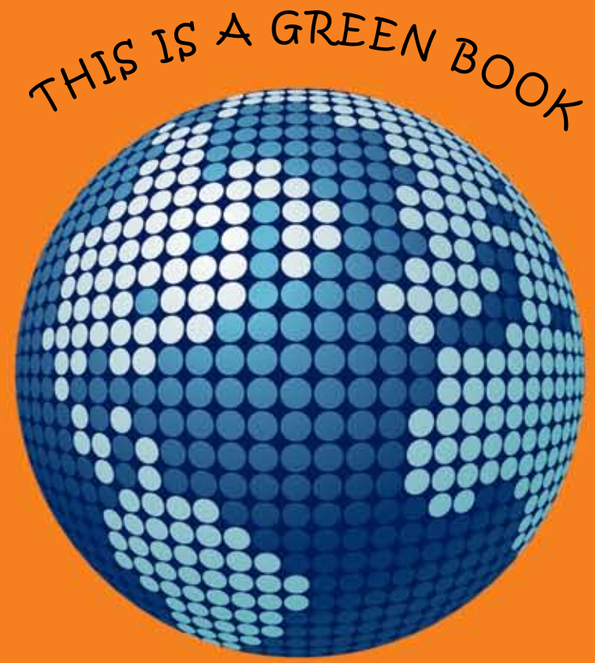
Turbine— type of motor that moves by the action of water, steam or gas

Volt— unit to measure the strength of an electric current

Yaw— movement of the tower top turbine, which allows the turbine to stay into the wind

Zero carbon— where carbon is not given out

Index



First published in 2008
Reprinted in 2009

TERI (The Energy and Resources Institute)
Darbari Seth Block, IHC Complex, Lodhi Road, New Delhi - 110 003, India
Tel. 2468 2100/4150 4900, Fax: 2468 2144/2468 2145
India +91 ▪ Delhi (0)11
Email: teripress@teri.res.in ▪ Website: http://bookstore.teriin.org

Adapted for UAE by Environment Agency, Abu Dhabi

ISBN 81-7993-146-3

Adaptation Material: Environment Agency, Abu Dhabi
Managing Editor: Madhu Singh Sirohi
Series Editor: Pallavi Sah
Art Direction and Concept: Priyabrata Roy Chowdhury
Cover Illustration: Sudhakar Gautam
Illustration and Design: Brijbasi Art Press Ltd.

PICTURE CREDITS
Key: t=top, b=bottom, m=middle, l=left, r=right, c=centre
20–21 rm Landsat 7 Science Team and NASA GSFC/Earthobservatory, 24–25 cm NASA, 35 bc NASA

Printed and bound in India

This book is printed on recycled paper

SAVE PLANET EARTH

KNOW CLIMATE CHANGE

Author
Tanya Luther Agarwal

Terrapin

Note from Mr. Majid Al Mansouri

It is He, who made you trustees of the earth,
And exalted some in rank over others.
In order to try you
By what He has given you
Indeed your Lord's retribution is swift
Yet He is forgiving and kind.

Verse from Holy Quran –Surat Al Ana'am

Ayah 165 (6:165)

Climate change today is threatening our planet and in fact our very survival on earth .All countries and governments are concerned as we humans have contributed to this malaise. To find solution to any problem, we must first fully comprehend it. Hence Environment Agency – Abu Dhabi (EAD) in association with The Energy Research Institute (TERI) is adapting and bringing this save planet series of books on Climate change to children in the UAE with a hope that students as future custodians of our environment learn about what ails our mother earth, how each one us impact the environment through our actions, so that they are in a position to make appropriate decisions on matters that affect the health of our planet.

Climate change is expected to have direct and indirect impacts on earth. Scientists predict that we would lose nearly one third of our biodiversity, Sea levels would rise flooding low lying areas, face severe fresh water shortages , desertification , health issues such increased incidences of infectious diseases, heat strokes, forest fires, hurricanes and extreme and strange weather patterns to name some .

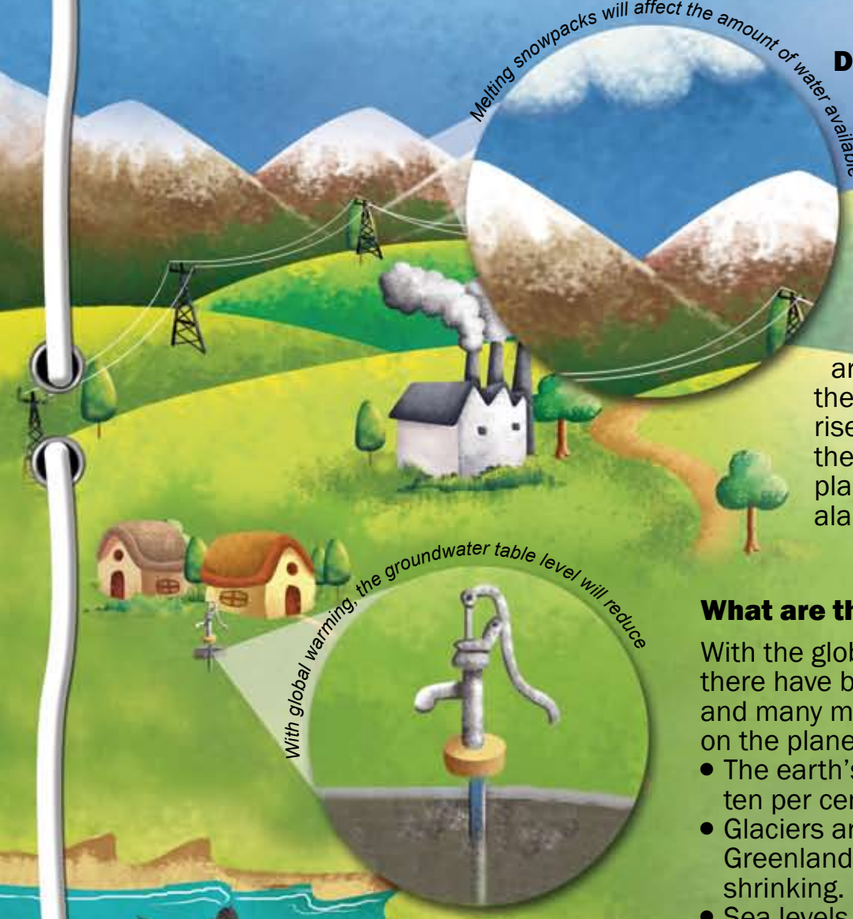
While governments are trying to fathom this new reality and looking at ways and means to tackle this global issue, it is becoming clearer to all, that only a concerted and collaborative action from each and everyone can actually help save this unique planet. United Arab Emirate too is aware of its responsibility and that is why despite being a country which is endowed with vast reserves of petroleum, a non renewable resource, and the one which contributes to climate change, it is working hard to establish the first carbon neutral city MASDAR in the coming few years and invest more on developing the renewable source of energy in the country. In addition, the country is also aiming to educate its future generation, through imbibing sound knowledge, imparting skill and helping to develop right attitude towards the environmental issues so as to prepare them to face any eventualities in the future.

We hope these books would be read by all students and would help them to understand the issue of climate change and the role that they can play in helping to save this unique planet.

CONTENTS

Is it just me or are things getting hot around here?

Global warming is the rise in the temperature of the earth's surface and the air over a period of time. The earth's surface and air have slowly been warming up over thousands of years. But in the past century, our planet has been warming up faster than ever before.



Does the earth have a fever?

Just as your body gets warm when you have a fever, the earth too seems to be running a fever. If your fever rises very quickly it becomes a cause for concern. Scientists around the world are just as worried because the globe's temperature has risen by 0.6 degree Celsius in the last hundred years. For a planet as big as ours, that is alarming!

What are the symptoms?

With the global warming fever, there have been many problems and many more noticeable changes on the planet.

- The earth's snow cover has melted by ten per cent.
- Glaciers around the world, such as Greenland's ice sheet, have been shrinking.
- Sea levels have risen.
- Ocean temperatures have risen.
- The sea ice at the North Pole has been melting very quickly.
- The winter season around the world has become shorter by two weeks.
- Heat waves have become more frequent.
- There are more floods and droughts.
- There is lesser rainfall in food-producing parts of the world.

How did the globe get so sick?

People on the earth have been doing many things to make their lives better without thinking what that would do to the earth. They have cut down forests to make their homes; poured dirty water into rivers, lakes and oceans; choked the air with dust and dirt; and buried their trash in the soil. All parts of the earth have been infected with 'germ-o-people'.

If doctors were to advise the earth on how to get better, they would probably say, "Stay away from people".

Eco watch

Our planet is warming very quickly. The last two decades of the twentieth century were the hottest in four hundred years and possibly the warmest in several thousand years. The last eleven years have been among the warmest since 1850!

The higher you go

If you hold your hand close to your mouth and blow on it you will feel something, a sensation. That feeling is caused by air, which is everywhere. Air makes up the atmosphere around our planet. It surrounds the earth like a blanket from the ground to about nine thousand six hundred kilometres high. The atmosphere hangs above the earth and does not vanish or blow away into space because the earth's gravity, or 'pull', keeps it in place.

What is atmospheric pressure?

The air around us is always pushing and pressing down on us. This is the atmospheric pressure. We cannot feel this air pressure like we can feel hot or cool air, but that does not mean it is not there. In fact, atmospheric pressure keeps changing from time to time and place to place. A barometer is an instrument that helps scientists measure atmospheric pressure.

Layers in the atmosphere

There are five layers in the atmosphere. The heaviest layer is closest to the earth's surface. As we move upwards from the ground level, the atmospheric pressure decreases and the temperature changes. Water vapour, carbon dioxide, methane, nitrous oxide, and chlorofluorocarbons are gases that are found in the atmosphere.

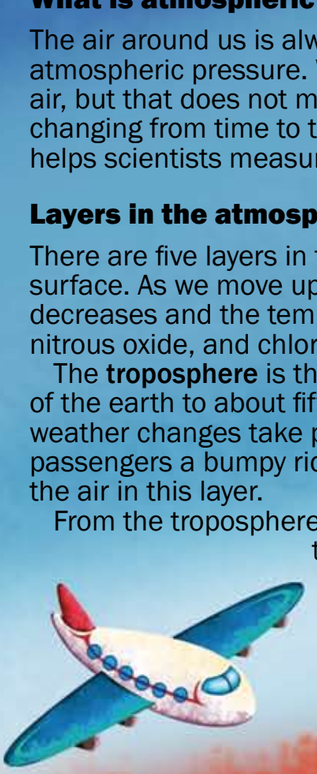
The **troposphere** is the layer closest to the earth. It extends from the surface of the earth to about fifteen kilometres high. This is the layer where almost all weather changes take place. Flying in an aircraft in the troposphere is likely to give passengers a bumpy ride because the air in this layer is always moving. We breathe the air in this layer.

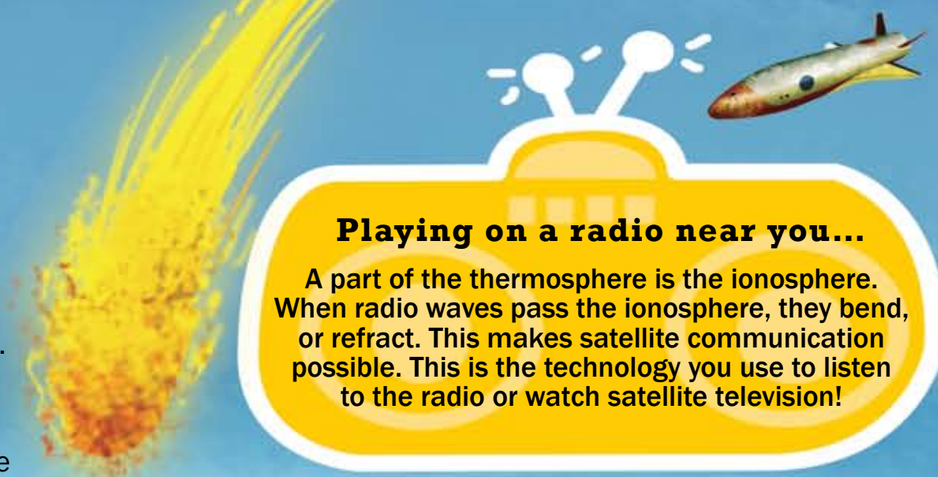
From the troposphere up to fifty kilometres is the **stratosphere**. Airplanes fly in this layer because it is very stable. The ozone layer is present here, and it absorbs the harmful ultraviolet rays of the sun that would otherwise be harmful to plants, animals, and humans.

Beyond the stratosphere, the air is very thin and cold. This area is known as the **mesosphere**, and is found between fifty and eighty-five kilometres above the earth's surface.

The thermosphere is the fourth layer in the atmosphere, between eighty-five and six hundred kilometres above the earth. Space shuttles orbit in this layer. Temperatures here can reach 1,727 degrees Celsius!

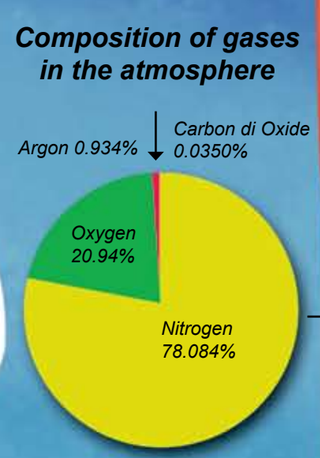
Beyond the thermosphere is the **exosphere**. This is the layer where the atmosphere and space meet. Satellite stations are located between six hundred kilometres and thousand kilometres above the earth.





Playing on a radio near you...

A part of the thermosphere is the ionosphere. When radio waves pass the ionosphere, they bend, or refract. This makes satellite communication possible. This is the technology you use to listen to the radio or watch satellite television!



What do these gases do for life on earth?

Although we cannot see, feel or taste the gases in the atmosphere, they are extremely important for life on the earth. They protect the earth from the sun's rays and also help keep a balance between extreme temperatures during the day and night. Without these gases, we would burn during the day and freeze at night.

If we did survive extreme temperature, meteors and comets would bombard the earth all the time! Most meteors burn up as they pass through the atmosphere before they reach us. This keeps us safe.

- **Troposphere -** *All weather changes take place here.*
- ***Stratosphere -*** *Very stable, absorbs harmful rays from the sun. Jet aircrafts fly here.*
- ***Mesosphere -*** *Meteors or rock fragments burn up in this layer*
- ***Thermosphere -*** *Space shuttle orbits here. This is the layer with auroras.*
- ***Exosphere -*** *A thin and the upper limit of our atmosphere.*

You can't live without this greenhouse!

The atmosphere turns the earth into one massive greenhouse. A greenhouse is a glass shed used to grow plants, especially during winter. The glass panels let in the light and heat from the sun. The heat gets trapped inside and cannot escape from the greenhouse. The house heats up and gives out warmth to the plants. This natural process is called the 'greenhouse effect'.

The gases in the atmosphere work like glass panels. The sun's hot rays enter the atmosphere through the gases. They hit the land and water, heating them both during the day. Light and heat are reflected back from the planet's surface, and while some of it escapes into space, the rest of it becomes trapped because of the gases that act like a lid or a cover around the earth. This is a good thing and helps keep a cozy average global temperature of sixteen degrees Celsius. Without the greenhouse effect, the planet would be a freezing minus eighteen degrees Celsius. Brrrr!

What are the natural greenhouse gases?

One per cent of the atmosphere is made up of greenhouse gases. These are water vapour, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O).

So what's the fuss about?

It's really more than a fuss. The natural balance of greenhouse gases has been ruined in the last two hundred years. Things that people are doing on the planet have increased the amount of greenhouse gases in the atmosphere. This has contributed to global warming.

Man-made gases

CO_2 is produced naturally by humans and animals when they breathe, and is absorbed by trees and plants. Volcanoes also let out this gas. With increasing number of people on the earth, trees are being cut down for towns and cities. With fewer trees to take in CO_2 from more humans living on the planet, the amount of this gas has gone up. To make things worse, burning fossil fuels such as coal, oil, and gas adds more CO_2 to the atmosphere.

This won't just blow over!

Methane is among the deadliest greenhouse gases. It comes from cows, sheep, rice fields, and the oil industry. The gas is twenty-three times more efficient in trapping heat in the atmosphere than carbon dioxide (CO_2). It lasts twelve years in the atmosphere before it turns into CO_2 and water.

Methane gas is produced by cattle when they digest their food. It also comes from rice fields and landfill sites, where garbage is disposed. Both of these are created by people. CFCs are present in small quantities in the atmosphere. They are also used in spray cans, refrigerators, chemicals, and in the making of plastics. They are dangerous gases because even small amounts can trap large amounts of heat.

What does it all mean?

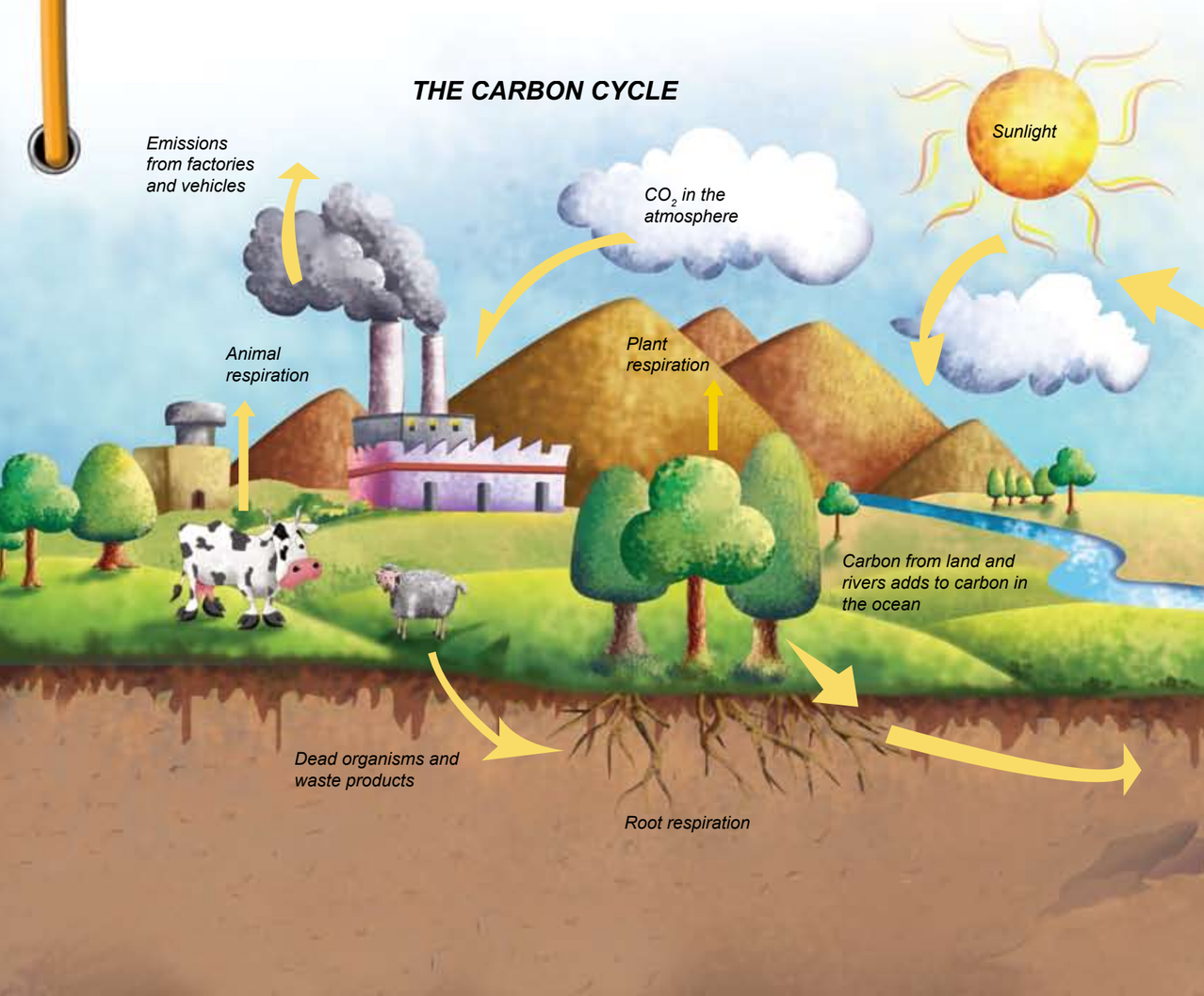
More gases in the atmosphere mean a thicker blanket around the globe that traps more heat, which simply means a rise in global temperature.

The carbon cycle

All living things are made of carbon. Non-living things like oceans and air also contain carbon. Carbon is also present in greenhouse gases. It is a part of the carbon dioxide (CO_2) gas in the atmosphere. Carbon is contained in fossil fuels like coal and oil under the ground. Rocks and shells of some animals have it too. Carbon is part of the soil, plants, and trees. The cycle actually changes the form of carbon from water to land to air to living things.

It's on the move in a cycle!

Carbon does not stay still. It is constantly on the move between land, water, and air. This is called the carbon cycle. Yet, not all carbon moves and may often get sealed in rocks in the oceans.



On land...

Plants and trees need carbon to grow. During photosynthesis, they use the CO_2 in the air to make food. This food is rich in carbon. Plants also give out CO_2 during respiration. When plants die, they become part of the soil and over time, turn into fossil fuels like oil and coal.

Humans and animals give out CO_2 when they breathe. This is added to the carbon in the atmosphere, some of it being used up by plants and trees.

In water...

Gases that have carbon move between the surfaces of oceans, seas and lakes, and the atmosphere. Like land plants, ocean plants too use photosynthesis to get CO_2 from the water and release it through respiration. Ocean animals eat these plants and when they die, the carbon in their bodies passes on to other animals, while some gets buried in the ocean floor. Some ocean creatures also use carbon from the water to make their shells. Over thousands of years, the bones and shells of these animals turn into rocks that contain – take a guess – carbon!

Floods, volcanic eruptions, typhoons, and hurricanes also move carbon from one place to another. No wonder then that carbon is everywhere!

The cycle can only carry so much!

When too many people sit on a cycle, it is either hard to move it or the weight of the riders makes for a wobbly ride. That is what people have managed to do to the balance of the carbon cycle. More CO_2 is being breathed out; burning fossil fuels has added thirty per cent more carbon to the air than there was a hundred and fifty years ago; trees have been cut down; and there are more vehicles on the road that emit CO_2. The amount of CO_2 on the earth today is more than what nature can manage, and scientists believe this is one of the causes of global warming.

Hard facts!

The world produces about two tonnes of concrete for each person on the earth every year. Cement, which is used to make concrete, is the world's most widely used building material. Each year, manufacturing cement gives out five to ten per cent of the world's total CO_2 emissions!

Something has changed

When global temperatures increase, the climate of the earth also changes. But what is climate? Is it the same as weather? When you look out of the window or step outdoors, you can see if the sun is shining or whether it is raining. It may be a windy day or a cloudy night; a sultry evening or a still afternoon. Is that weather, or is it climate?

Wondering whether it's weather!

Weather is what goes on in the atmosphere in a particular place at a certain time. In most places, the weather changes from hour to hour, day to day, and season to season. Newspapers and television channels give daily reports on what the weather was and what it will be the following day or even in the coming week. Everyone knows what weather to expect during summer or winter months in the place where they live. Ask people in Cape Town what the weather is like in June and you will be told that is it 'usually' cool and pleasant. They know that because that has been the weather there in June for many, many years. That is what climate is. It is the long-term and typical weather of a place.

Since weather changes all the time it is difficult to know the weather of a place weeks or months ahead. Climates of different parts of the world, however, are already known. For example, a Mediterranean climate has wet winters and dry summers; a Tundra climate has long, severe winters and short, mild summers. Even so, climates also change for short periods of time in a year. Those changes make our seasons. Climatologists study how climates come about and the effects on the environment. Meteorologists focus on and predict changes in the weather.

Chill box

If you thought 'cold' and 'desert' did not go together, know this. The Arctic is known to be a cold desert. The North Pole has long, dark winters and short, cool summers. The air here is very cold and dry. If you had to stick your hand in the freezer of your refrigerator for a few minutes you probably would not be able to do it even for that long. The temperature in your home freezer is minus twenty degrees Celsius. In some parts of the Arctic, temperatures drop to minus sixty-eight degrees Celsius! Brrr!!

Has the climate changed in the past?

Yes it has! There was a time when large areas of our planet were covered with huge, thick ice sheets and enormous glaciers. About forty million years ago began the first ice age, and there have been four such icy times since then. Glaciers have grown and shrunk, and at one time, reached where New York City is today.

What makes climate change?

In the last five billion years, the earth's climate has been changing constantly. Since humans were not around then, there must be other reasons for the changing climate.

The sun gives out energy and heat that we can all feel. However, small changes in the sun's energy, which we don't notice, have a huge impact on our climate. Scientists are still learning and trying to understand the extent of the effects.

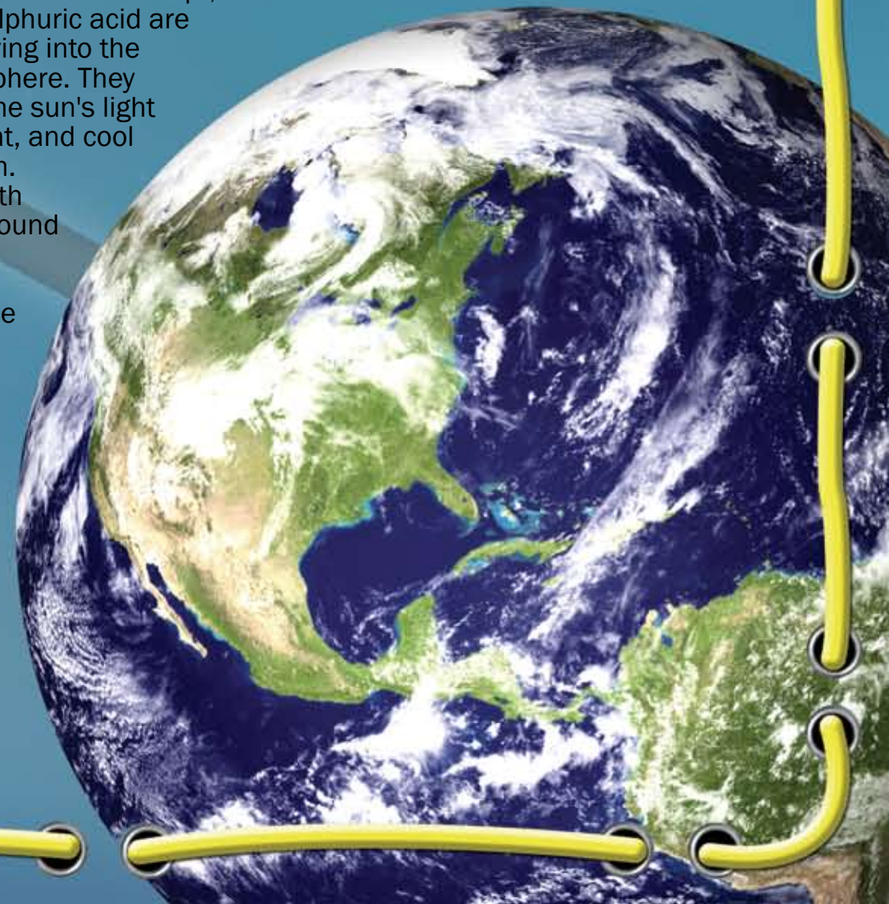
Clouds can either warm or cool the globe, depending on their distance from the ground, as well as their thickness. High-level thin clouds warm the earth, while low-level thick ones lessen the warming.

Ocean currents and winds carry heat towards the poles.

Changes in deep seas and oceans produce not just long-lasting climatic changes but also climatic effects such as the El Niño and the La Niña, which occur over and over again.

When volcanoes erupt, ash and sulphuric acid are sent flying into the atmosphere. They block the sun's light and heat, and cool the earth.

The earth revolves around the sun in a path, or orbit. Slow changes in the earth's orbit can alter the planet's climate over tens of thousands of years. Scientists think that this, along with ocean currents and winds, may have influenced the ice ages.



'El' who?

If seasons make weather, then El Niño makes global weather. El Niño is a natural cycle of the ocean–atmosphere system, as much as winter cold or summer thunderstorms or any other weather phenomenon.

The earth's warmest waters are in the central western Pacific Ocean. When the sun's heat warms the ocean, the water at the surface begins to evaporate quickly. Strong winds known as trade winds carry the warm air, as well as drag the warm ocean waters westward towards Indonesia and Australia. However, every few years, the trade winds are not strong enough and the result is that the warm water and warm air end up moving eastward along the coast of South America. This changes atmospheric circulation and weather patterns around the globe and is called El Niño.

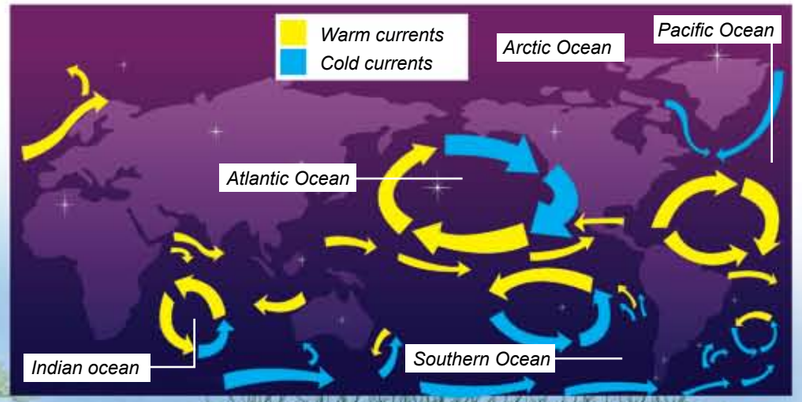
What makes El Niño?

No one knows for sure what causes an El Niño build-up. Some scientists think that strong trade winds near the equator push ocean water against Australia and Indonesia. The water piles up here and hits the coasts. Others think that the warm air that rises from the oceans makes the trade winds stronger. It is also possible that one El Niño causes another.

What does El Niño do?

El Niño climate conditions occur every few years, and they are not predictable. EL Niño has abnormal effects on temperature, wind, cloud formation, ocean currents—in short, on climate around the world. The most severe effects are found close to the equator. When an El Niño develops, it reverses weather patterns around the world.
The 1982-83 El Niño was the most terrible weather event of this century, causing disasters on nearly every continent. Africa, Australia, and Indonesia were affected by droughts, dust storms, and brush fires. Peru was drenched with eleven feet of rain in areas, where six inches was normal. Forest fires burned in Sumatra, Borneo, and Malaysia, and the haze forced drivers to use headlights at noon. The haze travelled thousands of kilometres to the islands of Maldives. In Mongolia, temperatures reached forty-two degrees Celsius; Kenya's rainfall was hundred centimetres above normal; central Europe suffered record flooding, and tornadoes tore through Florida. The worldwide human death toll was two thousand and the damage was calculated at thirteen billion dollars!

Today scientists can predict El Niño up to a year in advance, using complex computer simulations and data from other satellites.



The ocean waters move in a constant cycle, affecting the weather patterns of a place.

Droughts in South East Asia

Forest fires blazed out of control in Indonesia and Australia

Rainy winters in the US

PACIFIC OCEAN

Droughts in Indonesia and Australia

Powerful hurricanes in the US and Mexico

Heavy rains in Ecuador and forest fires in Brazil

Are they related?

Where there is an El Niño there is a La Niña! La Niñas bring climate patterns that are opposite to, and follow, El Niños. Where there is flooding with El Niño, there will follow a drought with a La Niña. Some effects are good ones such as grass growing on barren land and planting of rice and beans in otherwise dry areas in parts of Peru.


Weather balloon

Detectives at work

Climate scientists work a lot like historians, geologists, and detectives, all rolled into one. To know about climate in the world today and tomorrow, they dig into the past, as well as keep track of the present. They search for and gather clues in the history of the earth to understand the changes in climate, temperatures, and life on the planet.

Old finds

When snow falls, it carries elements like dust, nitrate, and so on from the air, which freeze and get preserved. As more snow falls over the years, it traps air bubbles too. To know the climate of thousands of years ago, scientists drill holes in ice sheets and pull out 'ice cores', or ice samples, and study these.

The same is done from mountains and deserts. Bones and fossils can tell us a great deal about life forms and the conditions they lived in. Samples from the ocean floor reveal how ocean currents flowed in the past and the climate conditions they caused. Trees can grow to be hundreds or even thousands of years old. A tree's age can be known by counting its rings inside the bark. One ring grows for each year. Variations in the formation of tree rings also show how much rainfall, snowfall or temperature changed each year in its surroundings. With that information, experts can find out the changes in temperature and rainfall over these years.


Tree rings

New clues

From the air to the ground, science detectives have virtually covered every part of the planet and around it to track changes in temperatures every day.

Weather stations on land use barometers to measure atmospheric pressure on the earth. They also note wind speed, rainfall, and storm activity.

Weather balloons may not be fun for kids but scientists love them. The balloons are loaded with instruments and let off to fly high up into the atmosphere. The science detectives at the ground, then, receive weather-related information. Floating on oceans and seas, buoys record changes in the weather. Weather satellites orbit the earth and beam down information to earth stations.

What does all this mean?

It simply means that we are learning more and more about how climate has changed and continues to do so over time. We know from this information that while nature plays its part in climate change, humans too have contributed in warming global climates. Scientists and environmentalists all over the world want people to understand how human activity has speeded up global warming and to do something about it before it is too late.

Taking the hint

After studying fossils as old as five hundred and twenty million years, some scientists say that mass destruction of species happened during periods when the earth's climate changed. Temperatures increased during four of the five times the mass extinctions occurred!


Drowning mangroves


Melting glaciers

Fingerprints of Climate Change

The global climate has changed and is changing. Fingerprints of global warming are heat waves, rising seas, and melting glaciers. Scientists have been recording these changes and also studying what causes these dramatic trends in climate change.

It's not cool to be hot!

You will have to choose your summer destination carefully next year, especially if you hope to be in a cooler place than home.

The summer of 2007 broke temperature records across the world. Parts of Japan had the highest temperatures since 1933. Eastern and southern parts the United States had record highs in the month of August as well new daily high temperatures. Several countries in Europe sweltered that summer. In fact, according to the World Meteorological Organization, global land surface temperatures in January and April 2007 were possibly the warmest since 1880, at more than one degree Celsius higher than average for those months.

Since 1980, the earth has experienced nineteen of its twenty hottest years on record, with 2005 and 1998 tying for the hottest, and 2002 and 2003 coming in second and third.

Higher is not always better

In the twentieth century, sea levels around the world have risen by four to eight inches. That may not sound like much, but the fact that most of this water came from melting glaciers is a cause for worry. The expansion of ocean and sea waters due to the heat has also led to sea-level rise, which has led to the flooding of coastal areas.

The Sundarbans National Park in Bangladesh has been flooded by sea-level rise and affected seventy-five thousand square kilometres of mangroves. In Vietnam too the nature of mangroves is changing because of the salt coming in with the sea water.

Dripping and drying

Scientists have been keeping a close watch on the glaciers in the world. They can clearly see that most of the glaciers have shrunk faster in the last five to seven years than in the last one hundred and fifty years. Ten to twenty per cent of glacier ice in the European Alps has disappeared in less than twenty years. In 2002, a chunk of the Larsen B ice shelf in Antarctica collapsed and has been shrinking rapidly since then.

The polar ice cap is melting at nine per cent per decade. The Arctic ice thickness has reduced by forty per cent since the 1960s. In fifty years, the floating ice in the Arctic sea has melted by half.


Collapsing Larsen B ice shelf

Sinking fast!

Around the world, about fifteen to thirty metres of beach is lost when the sea rises by 0.3 metres.

Who made this mess?

Our planet is in a mess, and you don't need to look very far to see it or smell it.

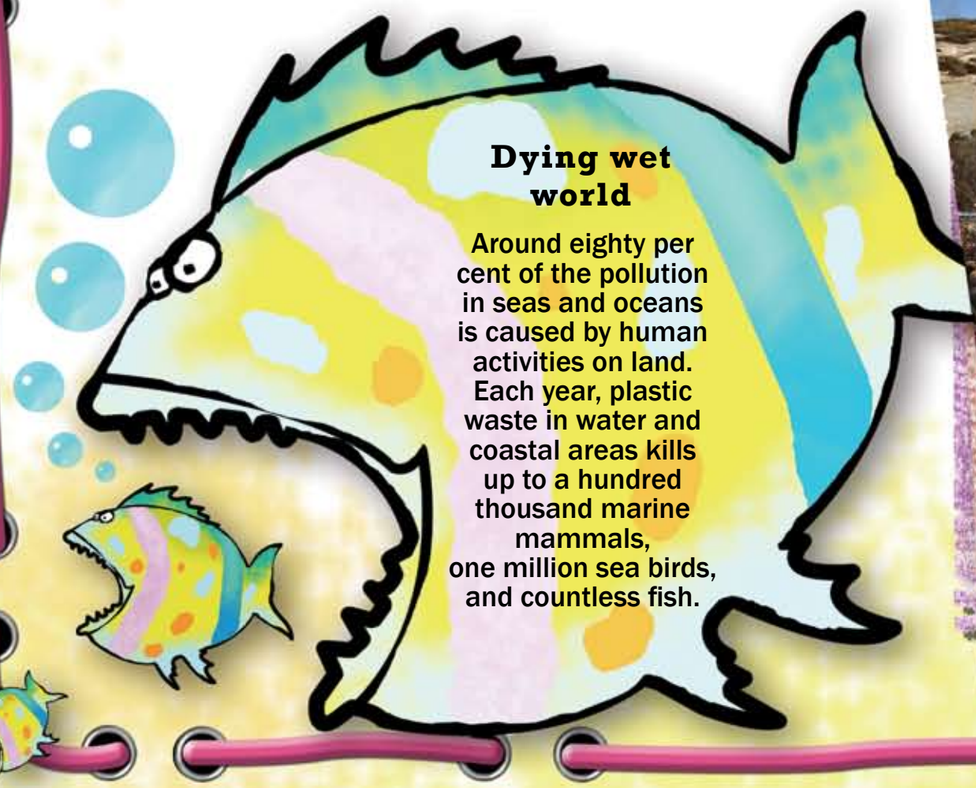
When air, water or land become dirty due to harmful chemicals or substances, they are said to be polluted. Pollution can also happen naturally as with volcanic eruptions or because of things that humans do, such as with spilling of oil or chemicals in oceans. Pollution of air, water, and land are the three major kinds of pollution on our planet.

Something in the air

Sometimes you see it, and sometimes you don't. Some air pollutants are invisible and others create a cloud or haze.

Beijing, Hong Kong, New York City, London, Toronto, Houston, Athens, and Mexico City are some of the places affected by 'smog'. This is a combination of smoke, fog, and sulphur dioxide gas that comes from industries and burning coal. Erupting volcanoes and forest fires can also create smog-like haze.

The 'big six' gases that pollute the air are carbon dioxide, carbon monoxide, sulphur oxide, nitrogen oxide, hydrocarbons, and particulates.



Dying wet world

Around eighty per cent of the pollution in seas and oceans is caused by human activities on land. Each year, plastic waste in water and coastal areas kills up to a hundred thousand marine mammals, one million sea birds, and countless fish.

Land pollution stinks!

Where do you think the trash that comes from your home goes? It is dumped in a landfill. Almost half of our trash is disposed of in landfills, while only two per cent of it is recycled.

Soil on land is polluted by pesticides, weed killers, and litter. Food garbage, wood, plastics, and construction materials find their way to landfills. So do vehicle parts and farm and mining wastes. Over time, the pollutants from land ooze around and spread, mixing with the groundwater, the soil, and even nearby rivers and lakes. The loss to humans is fifteen million acres of land every year.

Liquid mess

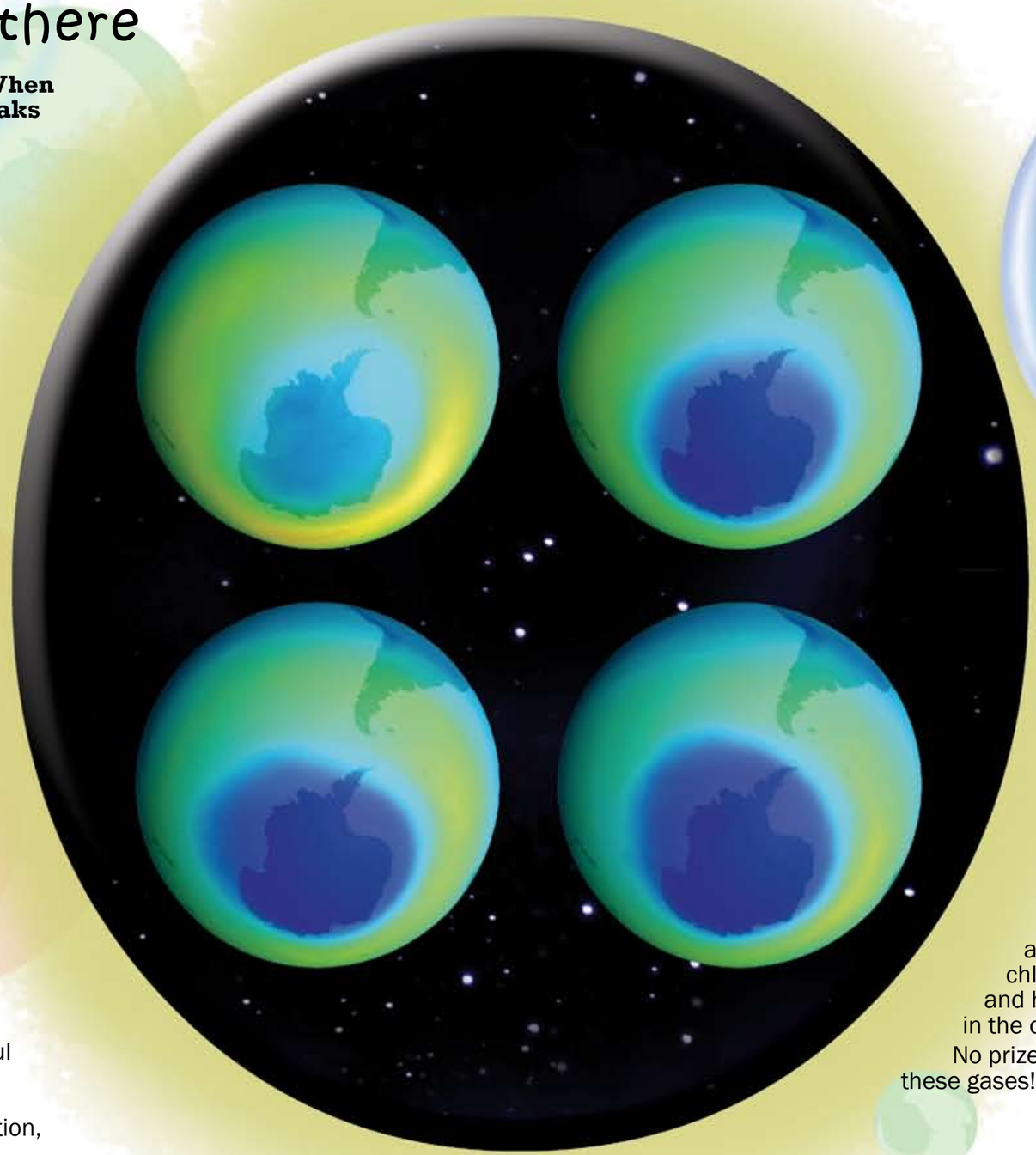
If you knew how polluted water is, you might find it hard to take that next sip.

Humans contaminate water in many ways. They dump raw sewage, chemicals, trash, pesticides, and poisonous waste into lakes, rivers, and oceans. Oil spills, in the high seas, cause the worst imaginable kind of pollution for the atmosphere and ocean creatures, coating their bodies with a thick layer of oil, making it difficult for them to breathe.

Polluted water also finds its way into the soil, crops, fish, fruits, animals, and finally, into our bodies.

There's a hole up there

We breathe in Oxygen and it is present everywhere, even in the stratosphere .When sunlight hits an Oxygen molecule it breaks it up into two parts to make an Ozone molecule. Ozone is a colourless gas in the atmosphere. It is made naturally with the action of sunlight. O_3 is found in two different layers of the atmosphere. It is identical in both layers but behaves very differently. The earth's ozone layer is about three millimetres thick, about the same as two coins stacked one on top of the other.



Nearly bad; good from far

Ninety per cent of all O_3 is the 'good ozone' that is present in the stratosphere, about seventeen to fifty kilometres above the earth. Here O_3 forms a protective shield and blocks nearly all the harmful ultraviolet (UV) rays of the sun. Some UV rays do reach the earth and that is why people are advised to wear UV-protective sunglasses and use sunblock lotions. UV radiation can cause sunburn, skin cancer, and eye damage.

In the troposphere, near ground level on the earth, O_3 behaves badly. It is formed when polluting gases from cars and power stations mix with sunlight and heat and lingers near the surface of the earth. The highest levels of O_3 are, therefore, found during summer. When O_3 is this close to the earth, it acts as a harmful pollutant. It dirties the air and creates 'smog'. This is bad ozone, which often gets carried by winds to hundreds of kilometres around. Pollution, especially air pollution, not only causes global warming, it also leads to Ozone (o3) depletion.

O_3 Cleaner

Ozone is the most efficient natural substance used for purification. It destroys bacteria, fungi,cysts when it comes in contact with water, air or any food item. This is why it has been used for water treatment for over hundred years!

The zone with the hole in it

In 1984, scientists discovered that the O_3 above Antarctica was thinner than expected. This led them to look at other places on the earth and they found that the North and South Poles, Europe, and South America, among other places, had a general loss of O_3. This came to be known as the 'ozone hole.'

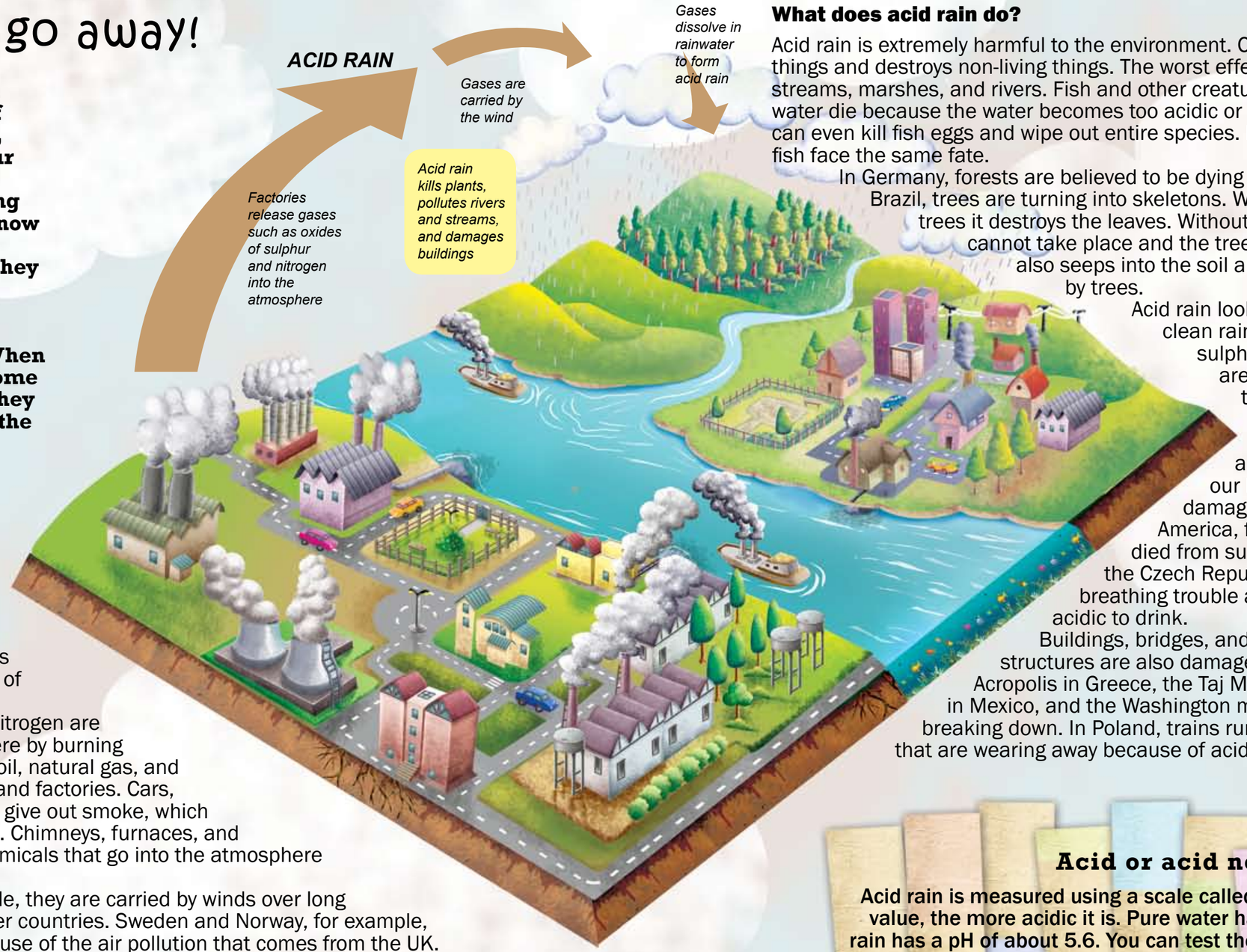
Scientists also learned what caused these 'holes'. Gases that came from refrigerators, air-conditioning systems, and fire extinguishers, also known as chlorofluorocarbons (CFCs), halocarbons, and halons, were responsible for making holes in the ozone layer.

No prizes for guessing who produced these gases!

Rain, rain go away!

Do you know that rain is the purest source of water in nature. Sadly, the increase in sulphur and nitrogen in the atmosphere is affecting rain too! When rain, snow or fog mix with these chemicals in the air, they fall to the ground as acid rain.

All water has some amount of acid in it. When the levels of acid become higher than normal, they cause air pollution of the worst kind!



Anything but natural

Sulphur and nitrogen are both found in nature. Sulphur is found in coal, oil, volcanoes, and sea spray. Nitrogen makes up seventy-eight per cent of the atmosphere.

However, sulphur and nitrogen are released in the atmosphere by burning fossil fuels such as coal, oil, natural gas, and gasoline in power plants and factories. Cars, trains, and other vehicles give out smoke, which contains these pollutants. Chimneys, furnaces, and engines let out these chemicals that go into the atmosphere and become acids.

Once the acids are made, they are carried by winds over long distances, sometimes over countries. Sweden and Norway, for example, get a lot of acid rain because of the air pollution that comes from the UK. Some air pollution falls back to the earth but a lot of it gets washed down with rain, snow, hail, mist or fog.

What does acid rain do?

Acid rain is extremely harmful to the environment. Over time, it kills living things and destroys non-living things. The worst effect of acid rain is in lakes, streams, marshes, and rivers. Fish and other creatures that live in and around water die because the water becomes too acidic or polluted. In fact, acid rain can even kill fish eggs and wipe out entire species. Birds that feed on polluted fish face the same fate.

In Germany, forests are believed to be dying because of acid rain. In Brazil, trees are turning into skeletons. When acid rain falls on trees it destroys the leaves. Without leaves, photosynthesis cannot take place and the trees eventually die. Acid rain also seeps into the soil and kills the nutrients used by trees.

Acid rain looks and tastes just like clean rain. When it falls as rain, the sulphur and nitrogen in the air are inhaled by people, and this can cause breathing problems. As acid rain falls on the food we eat and the water we drink, our health can be seriously damaged by diseases. In North America, fifty-one thousand people died from sulphur pollution in 1982. In the Czech Republic, children suffer from breathing trouble and the freshwater is too acidic to drink.

Buildings, bridges, and other man-made structures are also damaged by acid rain. The Acropolis in Greece, the Taj Mahal in India, the Pyramids in Mexico, and the Washington monument are peeling and breaking down. In Poland, trains run slowly on some tracks that are wearing away because of acid rain.

Acid or acid not!

Acid rain is measured using a scale called 'pH'. The lower the pH value, the more acidic it is. Pure water has a pH of 7.0. Normal rain has a pH of about 5.6. You can test the acidity of your drinking water or rain water by dipping one end of a pH paper, or litmus paper, in the water for about two seconds. Remove it and compare it with a pH colour chart to know how acidic the water is.

It's happening to them

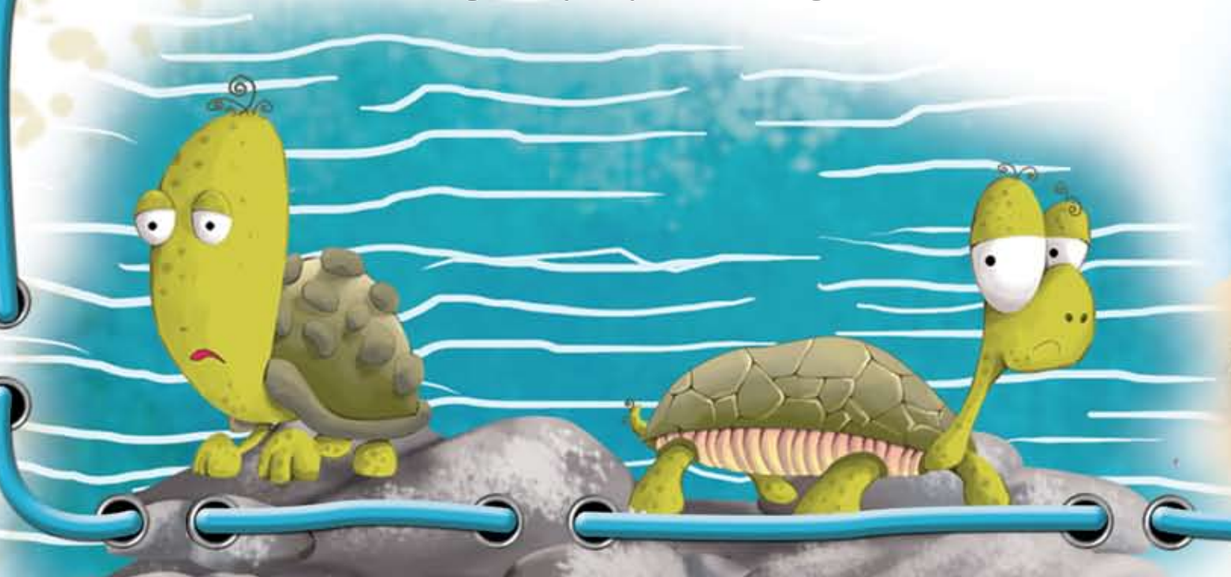
Birds, fish, land animals, plants, and ecosystems are all being affected by climate change. Even slight changes in temperature can cause endangered species to become extinct and threatened ones to become endangered.

Animals

It is hard enough living an animal's life. If global warming continues, animals that live in cold climates will be forced out of their habitats and will need to move uphill or towards the poles in search of food. This is already being seen in the Alps in Europe, in Queensland in Australia, and the forests of Costa Rica. Fish in the North Sea have begun moving northwards.

There is a long list of threatened animal species that could become extinct in the near future. The polar bear is facing shortage of food in the Arctic, and with its home under threat, this animal could be gone forever from the planet. Brazilian turtles are threatened by rising sea levels. This can affect their breeding and nesting and, in turn, their babies. The giant panda in China survives on the bamboo plant. As the bamboo habitats reduce due to climate change, pandas may be faced with starvation.

The warmer the climates the more likely are droughts and bush fires. If that happens in the rainforests of Indonesia, the orangutan will face extinction in the next few decades. Indian tigers, Australian frogs, and the African elephants are a few of the animals whose homes are being destroyed by climate change.



Birds

Leaving home in a hurry is never easy. Although birds can travel faster than other animals, there are some species that will not be able to make that move. If the planet warms more than two degrees Celsius, thirty-eight per cent of the birds in Europe and seventy-two per cent in north-eastern Australia could become extinct. Some bird populations that are decreasing are the tawny eagle in Asia and Africa, common guillemots around the coasts of Britain and Ireland, Arctic skuas and terns, and the Scottish crossbill. Warming of the earth is damaging the habitats of the Siberian cranes, tufted puffins, Galapagos penguins, red-tailed black cockatoo, and many other birds all over the world.

Climate change is considered to be a major threat to the common guillemots.

Conservationists are worried that unless action is taken to halt a rise in global temperatures, the Scottish Crossbill is under severe threat. This bird lives only in the Scots pine forests in Scotland.

There's a buzzzzzz...

They may be small but they have their timing right. With trees flowering sooner in spring, honeybees in Maryland, US, are starting their honey production earlier than usual.

Plants

Birds and animals can migrate to cooler places but for plants to sow their seeds in faraway places, without moving, would take a long, long time. Trees, shrubs, grasses, and plants are already feeling the heat. Trees are flowering earlier than usual and leaves are falling before time, almost as if plants and trees are confused about seasons. Coral reefs, alpine, mangroves, and rainforests may be lost forever to salt water rise and warmer air and ocean temperatures.

WARNING!

As the planet heats, twenty-five per cent of earth's species could vanish by 2050!

And it's happening to us

Climate change has a serious impact on the lives of humans beings too. Like plants and animals, human beings have to adapt to the changing climate, different weather patterns, and must battle graver diseases and natural disasters.

Diseases

A warmer earth would mean more frequent heat waves and milder winters. People in poor or developing countries would suffer higher heat-related deaths, especially among the young and the old. Mosquitoes breed in warm weather and that would mean more people becoming infected with malaria and dengue fever. The malaria mosquito would also be able to spread to other parts of the world. The West Nile virus, cholera, and lyme disease have been spreading across the US and Europe since 1999.

Food and water shortages

While on the one hand, sea levels would rise, on the other, there would be water shortages. Sea levels are already rising at twenty centimetres a century. Scientists think that global warming will cause sea levels to rise by as much as nine to eighty-eight centimetres by 2100. That would affect twenty-three million people in just five European countries, leave millions homeless worldwide, and threaten to wash away nations.
Floods, droughts, and storms would damage homes, human health, crops, and lead to diseases and food and water shortages.

Air pollution and UV radiation

Air and water pollution increase in higher temperatures. If our planet gets hotter by two degrees Celsius or more, people will suffer breathing problems. In the UK alone, higher levels of ultraviolet light could cause an extra five thousand deaths from skin cancer and may cause an increase of two thousand cases of eye disorders like cataract.

Another major problem would be an increase in ground-level ozone (the bad kind) and smog. If these levels go up they would cause death, affect the mental abilities of children, and lead to lung diseases.

Not a good count!

According to the World Health Organization, hundred and fifty thousand deaths and five million illnesses each year are caused by conditions directly related to climate change.

Will the culprit please stand up?

With all the mess and destruction around, you would think there's no hope for life on earth at all! Fortunately, all is not lost. People across the world realized they had to act fast to stop climate change. In 1992, representatives of 154 countries signed the United Nations Framework Convention on Climate Change (UNFCCC) at Rio de Janeiro, Brazil. This summit is famously known as the Earth Summit. It was thought that following the guidelines in the framework would control global warming. One of the most important achievements of the summit was an agreement on the climate change convention. This in turn led to the 'Kyoto protocol'. There was another agreement to "not carry out any activities on the lands of indigenous peoples that would cause environmental degradation or that would be culturally inappropriate". These rules would ensure that the world community at large, individuals as well as business communities, took real action to deal with the problem of global warming.

CO_2 and Kyoto

In 1997, representatives of more than one hundred and sixty countries met in Kyoto, Japan. They signed an agreement to cut down six greenhouse gases: carbon dioxide (CO_2), methane, nitrous oxide, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride. This came to be known as the Kyoto Protocol.

Countries were given different targets to reduce their CO_2 emissions, depending on how developed they were. Thirty-eight developed nations had to limit their CO_2 emissions and greenhouse gases to a certain number of units in a period from 2008 to 2012. If they managed to reduce their emission units more than what was required then they could sell the balance units to other countries that were emitting more than their share. Developing countries were not given any limits.

So far, 176 countries have accepted the Kyoto Protocol. Turkey and Croatia stayed away from the Protocol. The US did not accept it either but said it would work with other countries to control global warming.

In December 2007, the representatives of 187 countries met in Bali, Indonesia, to launch negotiations that would ensure that the new deal could enter into force by 2013, following the expiry of the first phase of the Kyoto Protocol.

Finally an agreement was drawn up under the Kyoto Protocol according to which industrialized countries will reduce their collective emissions of greenhouse gases by 5.2 per cent as compared to 1990. The goal is to lower the overall emissions of six greenhouse gases averaged over the period 2008– 2012.

Not so energetic!

In most countries, burning fossil fuels for activities related to the energy sector is the main source of carbon dioxide emissions. For instance, eighty per cent of the global greenhouse emissions are from the energy sector!

Tuesday, February 5, 2008

TOP NEWS

www.climatenews.in

The US, Japan, Russia, and the European Union together are believed to have given out seventy per cent of CO_2 emissions between 1850 and 2004. The US then became the global warming leader, giving out the most CO_2 emissions from burning fossil fuels such as coal and oil.

In 2007 the total U.S. greenhouse gas (GHG) emissions were 7,282 million metric tons. This is an increase of 1.4 per cent from the 2006 level. Since 1990, U.S. GHG emissions have grown at an average annual rate of 0.9 per cent.

After China and the US, the other top emitters of CO_2 are Russia, India, Japan, Germany, Brazil, Canada, UK, Australia, and Italy. But each American still produces more greenhouse gases than any other one person in the world.

Days after tomorrow

If you asked your doctor, "How healthy am I?", your doctor would not be able to answer the question by only looking at you. He/she would run some tests to check if your organs were functioning well, if your body was free of infections, and also ask you about past illnesses.
Similarly, scientists continuously check on the planet's health. They use computer models of the atmosphere and the oceans to predict how the earth is responding to higher levels of greenhouse gases. They also use information from the past, of rocks and soils, to test how accurate their models are. The GCMs (general circulation models) are the most advanced of these models and scientists are making some pretty scary predictions about the future of our planet.

The future of warmer temperatures looks like this...

Warmer temperatures will increase evaporation and increase the likelihood of droughts and wildfires from the Himalayas to the African bush, Siberia to southern France. Some other places will become drier and the Amazon rainforest may turn into a desert. Floods and droughts will become more frequent. Rainfall in Ethiopia, where droughts are already common, could reduce by ten per cent in the next fifty years.

Some scientists believe the planet is headed for a record-setting heatwave after 2009. From 2010 through 2014, each year would be fifty per cent hotter than 1998, the hottest year recorded so far. In the next one hundred years, the average global temperature is expected to increase by 1.4 degrees Celsius to 5.8 degrees Celsius. By the end of the twenty-first century, sea levels are likely to rise by nine millimetres and eighty-eight centimetres. This would threaten coastal areas from the North Sea to the swamps of West Africa. Islands in the South Pacific could disappear completely by 2100.

An increase of two to three degrees Celsius could melt most of the world's glaciers. The Himalayan and Alpine glaciers could be mostly gone by 2100. Those in East Africa and the Andes would disappear sooner. Climate change could bring more landslides, hurricanes, and smog. A possible increase in major storms, heatwaves, and flooding will be among the deadly effects, rather than the actual warming itself.

If things carry on as they are, with no one making efforts to reduce global warming, the results could be disastrous. Surprisingly, they could also benefit certain crops but only if the change in climate is small. The larger the change in climate, the bigger the negative effects for the planet.

The height of change!

The sherpas – many of whom are mountain guides – in Nepal have noticed that the glaciers around Mt Everest are melting quickly. Climbers used to take at least four days to get to the top from base camp. Today, with less ice and snow on the mountain, climbers can reach the summit in just eight hours!

What's your footprint size?

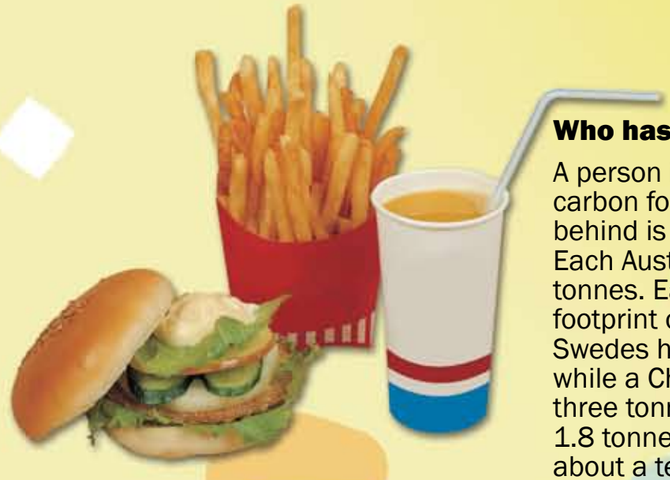
You probably have seen your wet footprint and shoe print but do you know that you also have another footprint that can be calculated? Every activity that you do, from brushing your teeth to switching on your television set, gives out a certain amount of carbon dioxide (CO_2). Environmentalists call this a carbon footprint.

People, schools, businesses, industries, homes, all have carbon footprints. Everybody's carbon footprint adds to global warming and climate change.

All human activities produce greenhouse gases. This is measured as CO_2 equivalent in pounds, kilograms, or tonnes.

Bigger isn't better

Developed countries like the US and Russia give out more and more CO_2 each year. Developing countries in Asia and Africa, with their growing population, are catching up. As people's lifestyles improve, they begin to use gadgets, such as electrical appliances and cars, which use more energy. Electricity is one of the biggest cause of CO_2 emissions. Each time people switch on a light or turn on the television, they are adding to global warming.

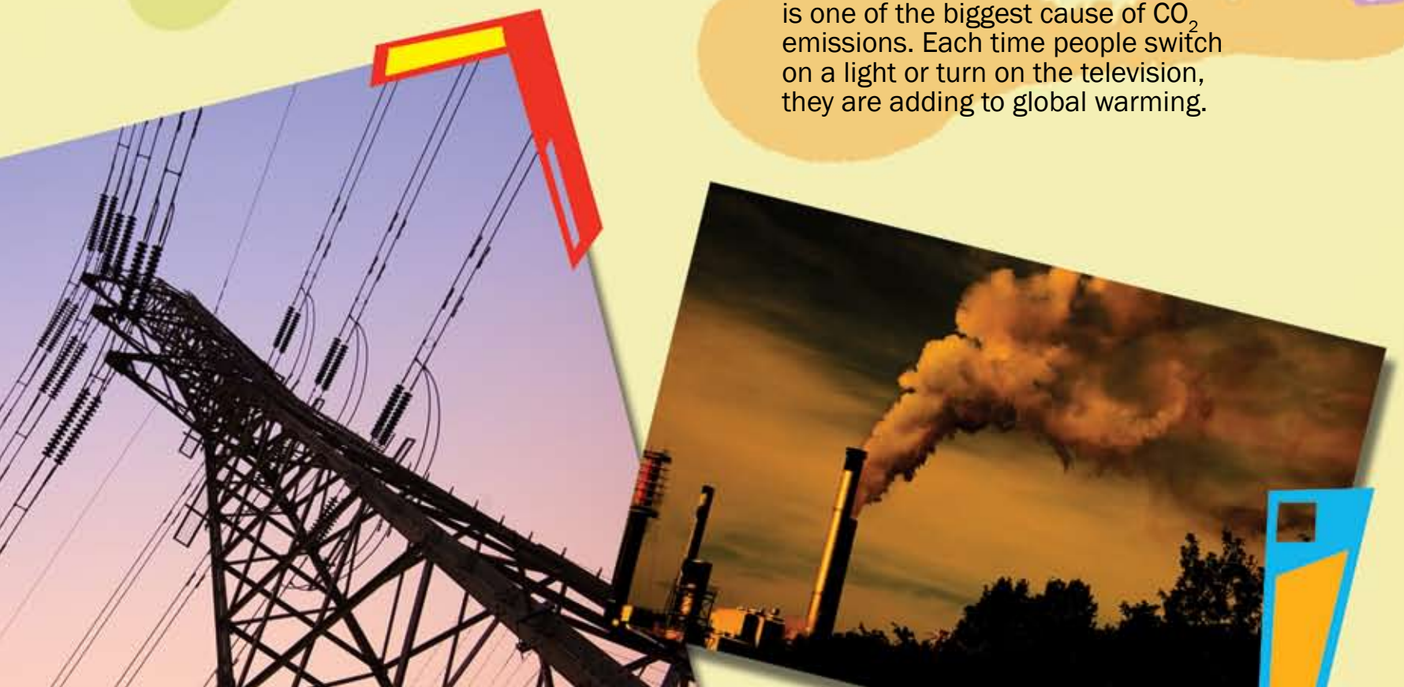


Who has the biggest footprint?

A person in Canada, on an average, has a carbon footprint of twenty-one tonnes. Close behind is an American, with twenty tonnes. Each Australian is responsible for eighteen tonnes. Each person in Britain leaves a footprint of nine tonnes. The Swiss and the Swedes have a footprint of six tonnes each, while a Chinese person's footprint is about three tonnes. An Indian's carbon emission is 1.8 tonnes and that of the average Ethiopian, about a tenth of a tonne. The smallest footprint in the world comes from the people of Chad—just one-hundredth of a tonne of CO_2!

With each step

Each of the following activities adds one kilogram of CO_2 to your carbon footprint: travelling a distance of ten to twelve kilometres by public transportation (train or bus); driving a distance of six kilometres in your car; flying a distance of 2.2 kilometres on a plane; operating your computer for thirty-two hours; buying two plastic bottles.



What's your size?

Your carbon footprint depends on many things: your age, where you live and, most importantly, how you live. The two biggest and most important human activities that make up a person's carbon footprint are transportation and home appliances or electrical gadgets a person uses. Even so, all your actions have some kind of effect on the amount of CO_2 you are sending out into the atmosphere. The food you eat, the clothes you wear, the paper you use—everything adds to your footprint. And each person's footprint makes the world warmer!

Usually, a carbon footprint is calculated for the time period of a year.

Do the earth a favour

If you have read enough to be worried about your carbon footprint and would like to be a size smaller, then here are some tips.

Saving energy

If people changed their lights bulbs in their homes to compact fluorescent lamps (CFLs), they would reduce their household emissions by about three hundred kilograms per year. Switching off lights/fans before leaving a room would save a huge amount of energy. Microwaves, televisions, DVD players, and other electrical gadgets that are left on standby not only use energy but also give out tonnes of emissions. By being more energy efficient at home, people can reduce their emissions, as well as lower their energy bills by more than thirty per cent.

Making energy-efficient homes with the right kind of building materials is another intelligent way to reduce greenhouse gases. Almost half of the energy used in homes goes into heating and cooling. Lowering the temperature in winter and raising it in summer by just two degrees Celsius could save the planet from thousands of tonnes of carbon dioxide (CO_2).

Low-carbon diet

Takeaway food can seem more delicious and convenient than home-cooked meals, but the foil packing that comes with it gives out more carbon than you can see. Strawberries from Spain in the UK, apples from California in India, and kiwis from Australia in the US are transported by burning fuel. Eating fresh and seasonal produce grown in nearby fields leads to a smaller footprint than when food is transported from far away places.

Cutting emissions

Using public transport to get to a place, car-pooling, walking or cycling are simple ways to keep the planet clean. Fewer vehicles on the road would mean less CO_2 emissions. If people carried a strong reusable shopping bag and turned down plastic bags, less trash would fill the landfills.

Doing the right Rs

People can prevent five hundred kilograms of CO_2 emissions if they cut down their garbage by ten per cent.

Almost half of a person's carbon footprint is made up of things used and thrown. Cans, bottles, paper, plastics, and metal are things that can be recycled and made into new materials or products. Reusing boxes, bottles, clothes, books, cloth napkins, and other usable things by repairing, selling or donating them also reduces waste. It is better to reuse than recycle because the item does not need to be treated before it can be used again.

Fitting solar panels for heating homes and water reduces fossil fuel burning. Using a composter to recycle garden and kitchen waste such as leaves, tea bags, and grass cuttings benefits the environment in many ways. It also reduces the need to use chemicals and fertilizers, as well as the load on landfills.

The three chasing arrows

This logo – the Mobius Loop – was designed on Earth Day in 1970. Today, it is recognized all over the world as a recycling symbol. If the logo is printed on a dark background it means that the item has been made from recycled material. If it is on a light background it means the item can be recycled.

FIVE STEPS TO SAVE ENERGY

- Turn off the lights when not in use
- Use public transport whenever possible
- Set your computer on a sleep mode after 15 minutes of non use.
- Replace light bulbs with CFL's
- Never exceed the speed limit and maintain a steady speed when driving.

Did you know?

An aquifer is an underground bed, or layer, of the earth that stores freshwater. When groundwater gets polluted it is very difficult to clean as it doesn't just 'flush out' on its own. Water that enters an aquifer remains there for an average of one thousand four hundred years!

Replacing ten hundred-watt light bulbs with CFLs reduces the same amount of carbon dioxide that an SUV emits over a year over the course of the bulbs' lifetime!

The good news is that nine out of ten people around the world are aware of global warming. The bad news is that only over half of them (fifty-seven per cent) consider it a 'very serious problem.' The Czechs are the most aware about global warming.

Some of the most polluted places in the world, 2007

- ***Sumgayit, Azerbaijan,*** forty factories release 70,000 -120,000 tons of detergents and pesticides into the air every year
- ***Linfen, China,*** where people actually choke on coal dust in the evenings. Severe air and water pollution from coal,steel and tar industries
- ***Tianying, China,*** largest lead production bases in China,with ver high lead concentrations in the air and the soil. Ten times more than the national health standards
- ***Sukinda, India,*** twelve chromite ore mines dump untreated water into the river, causing severe water contamination
- ***La Oroya, Peru,*** where a metal processing plant gives out toxic emissions of lead
- ***Dzerzinsk, Russia,*** a major chemical weapons manufacturing sites that were used until the end of the Cold War
- ***Norilsk, Russia,*** which is home to the world's largest heavy metals smelting factory
- ***Chernobyl, Ukraine,*** where the nuclear site disaster took place twenty years ago. The 19 mile exclusion zone around the site is uninhabitable

Make your own greenhouse

You don't have to be a scientist with a sophisticated laboratory to figure out how our planet is getting warmer. Try this simple experiment at home to know and understand more about the greenhouse effect.

Materials

- Plastic bottle
- Nail
- Two thermometers

Objective

The objective is to make your own small greenhouse and in a simple way to test its effect on temperature.

Procedure

1. Make a hole near the top of the plastic bottle with the nail and insert one thermometer.
2. Place the second thermometer next to the bottle.
3. Make sure that the same amount of sunlight reaches both the thermometers.
4. Record the temperature values of both thermometers after ten minutes or so.
5. Take the temperature records again after another ten minutes. Repeat that procedure a few times.

You will find

Both thermometers will record different temperatures. The one in the bottle will show a higher temperature because of the trapped heat in the bottle. This is your greenhouse effect in a bottle!

Glossary

Aquifer— an underground bed, or layer of earth, that stores freshwater. It generally holds enough water to be used as a water supply.

Antarctica— the continent centred on the South Pole. Antarctica is a plateau covered by mountains and ice, with ninety-five per cent of its surface under an ice cap, averaging one mile in thickness.

Atmosphere— a layer of invisible gases that surrounds and protects our planet and all life on it.

Barometer— an instrument that measures atmospheric pressure.

Buoy— a float placed in open waters to signal or warn ships of danger or of a shore nearby.

Carbon dioxide (CO_2)— a colourless, odourless, and non-poisonous gas found in the air in small amounts. Humans exhale it, and trees and other plants absorb it and use it to make food. It is a greenhouse gas.

Carbon footprint— the total amount of greenhouse gases given out by a product or person over its entire life cycle.

Carbon monoxide (CO)— a colourless, odourless, and poisonous gas that is released into the air when oil, coal, and wood are burned.

Chlorofluorocarbons (CFCs)— kinds of greenhouse gases found in the atmosphere. They are given out by refrigerators, air conditioners, and cleaning chemicals.

Climate— the expected long-term weather found in a region, such as a hot, dry desert or the cold, snowy arctic.

Climate change (often called global warming)— refers to: 1) rising global temperatures; 2) increasing floods and droughts; and 3) rising of sea level

Climatologist— a scientist who studies climate.

Composting— gathering together various types of plant material such as leaves, grass clippings, food waste, and sawdust usually in a pile and letting them rot naturally. This makes compost that is used as fertilizer.

Contaminants— substances that put air, water, soil or food at risk.

Ecosystem— a collection of plants and animals living in an area along with the things they need to live, such as a place to live, food, and water. An ecosystem can be as small as a tiny tide pool or as large as a vast desert.

El Niño— the name given to the changes in direction of winds over the Pacific Ocean. This causes abnormal warming of the ocean's surface in the eastern Pacific roughly every three to seven years. This ocean warming can strongly affect weather patterns all over the world.

Emissions— are gases that are given out by things like cars and burning fossil fuels.

Endangered species list— a list of animals and plants in danger of becoming extinct.

Fossil fuels— fuels such as oil, which come from decomposed living matter.

Geologists— scientists who study the history and structure of the earth.

Glaciers— large blocks of ice.

Greenhouse effect— a natural process by which gases in the earth's atmosphere trap the sun's heat and prevent the planet from freezing.

Greenhouse gases— gases that trap heat in the atmosphere. They include water vapour, carbon dioxide (CO_2), methane, and nitrous oxide.

Ice core— a sample of ice that is got by drilling a hollow steel tube into the snow and ice of many years.

Landfill— a gigantic pit that has been dug into the ground. It is where our garbage is dumped when we throw it out.

Methane— a non-poisonous gas. Ten percent of methane in the atmosphere comes from natural processes such as turning wood into coal and plant decay. More than eighty per cent comes from human activities such as burning fossil fuels.

Nitrogen— a natural gas that makes up nearly seventy-nine per cent of the earth's atmosphere.

Molecule— a group of atoms that are blended together chemically.

Nitrogen dioxide— a pollutant that causes smog and acid rain as well as eye, throat, and lung irritation. Nitrogen dioxide is mainly produced by burning fossil fuels.

Orbit— the curved path that planets follow around the sun.

Ozone (O_3)— a gas. Ozone high in the stratosphere is good, but near the earth's surface (where it is breathable), it is unhealthy.

Ozone layer— lies about fifteen to forty kilometres above the earth's surface in the stratosphere. It protects the earth from receiving harmful rays from the sun.

Ozone hole— a thinning of the ozone layer.

Photosynthesis— a process in green plants that uses the sun's light and CO_2 to produce food. Oxygen and water are also made during the process.

Pollutant— anything that makes parts of our natural environment dirty. For example, the tiny, often invisible specs of dirt that are spewed out by cars and trucks pollute our air, and are, therefore, air pollutants. Oil spilled into a lake or an ocean is a water pollutant; and garbage dumped onto land is a land pollutant.

Pollution— harm to a natural environment, such as air, water or soil through contamination with either natural or man-made materials.

Respiration— taking in and giving out air during the process of breathing.

Recycling— the process of reusing waste products.

Sea level— the level of the ocean's surface.

Smog— a word created in England in 1905 by combining 'smoke' and 'fog'. Originally it meant just that—smoke from burning coal and other fuels mixed with fog to create a haze. Now, it is used for any kind of air pollution found in cities.

Threatened Species— any plants, animals, insects, and other life form that is in danger and likely to become extinct in the near future.

Tree rings— the circular lines in a trunk of a tree. As a tree grows older it adds a layer of wood and its trunk gets thicker.

Ultraviolet (UV) radiation— a type of invisible light from the sun.

First published in 2008
Reprinted in 2009

TERI (The Energy and Resources Institute)
Darbari Seth Block, IHC Complex, Lodhi Road, New Delhi - 110 003, India
Tel. 2468 2100/4150 4900, Fax: 2468 2144/2468 2145
India +91 ▪ Delhi (0)11
Email: teripress@teri.res.in ▪ Website: http://bookstore.teriin.org

Adapted for UAE by Envirronment Agency, Abu Dhabi

ISBN 978-81-7993-144-8

Adaptation Material : Envirronment Agency, Abu Dhabi
Managing Editor: Madhu Singh Sirohi
Series Editor: Pallavi Sah
Art Direction and Concept: Priyabrata Roy Chowdhury
Illustration and Design: Brijbasi Art Press Ltd

Printed and bound in India

This book is printed on recycled paper

SAVE PLANET EARTH

REDUCE REUSE RECYCLE

Author
Tanya Luther Agarwal

Terrapin

Note from Mr. Majid Al Mansouri

It is He, who made you trustees of the earth,
And exalted some in rank over others.
In order to try you
By what He has given you
Indeed your Lord's retribution is swift
Yet He is forgiving and kind.

Verse from Holy Quran –Surat Al Ana'am

Ayah 165 (6:165)

Climate change today is threatening our planet and in fact our very survival on earth .All countries and governments are concerned as we humans have contributed to this malaise. To find solution to any problem, we must first fully comprehend it. Hence Environment Agency – Abu Dhabi (EAD) in association with The Energy Research Institute (TERI) is adapting and bringing this save planet series of books on Climate change to children in the UAE with a hope that students as future custodians of our environment learn about what ails our mother earth, how each one us impact the environment through our actions, so that they are in a position to make appropriate decisions on matters that affect the health of our planet.

Climate change is expected to have direct and indirect impacts on earth. Scientists predict that we would lose nearly one third of our biodiversity, Sea levels would rise flooding low lying areas, face severe fresh water shortages , desertification , health issues such increased incidences of infectious diseases, heat strokes, forest fires, hurricanes and extreme and strange weather patterns to name some .

While governments are trying to fathom this new reality and looking at ways and means to tackle this global issue, it is becoming clearer to all, that only a concerted and collaborative action from each and everyone can actually help save this unique planet. United Arab Emirate too is aware of its responsibility and that is why despite being a country which is endowed with vast reserves of petroleum, a non renewable resource, and the one which contributes to climate change, it is working hard to establish the first carbon neutral city MASDAR in the coming few years and invest more on developing the renewable source of energy in the country. In addition, the country is also aiming to educate its future generation, through imbibing sound knowledge, imparting skill and helping to develop right attitude towards the environmental issues so as to prepare them to face any eventualities in the future.

We hope these books would be read by all students and would help them to understand the issue of climate change and the role that they can play in helping to save this unique planet.

CONTENTS

Waste not, want not

If you think we were the first ones to come up with keep-it-clean campaigns and recycling, think again! We are certainly not the first ones to fuss about cleanliness nor the only ones to recycle waste.

Early humans used things found in the environment, and after they were done using or consuming them, they made new things out of them. Man ate the meat of animals and shaped the leftover bones into tools and weapons. And, thus, humans began 'recycling', or using trash and waste to make new materials from old ones.

Recycling, an old art!

When humans moved from hunting and gathering in the early days of their existence to farming, they took care of their trash intelligently. Ash from fires, wood, bones, bodies, and vegetable waste were all buried in the ground as they helped improve the soil.

2000 BC
The Chinese disposed of waste material by burying it in the soil.

400 BC
Ancient Greeks built garbage dumps almost two kilometres away from the city.

AD 1000
The Japanese have been recycling paper for almost a thousand years.

AD 1969
John McConnell came up with the idea of Earth Day.

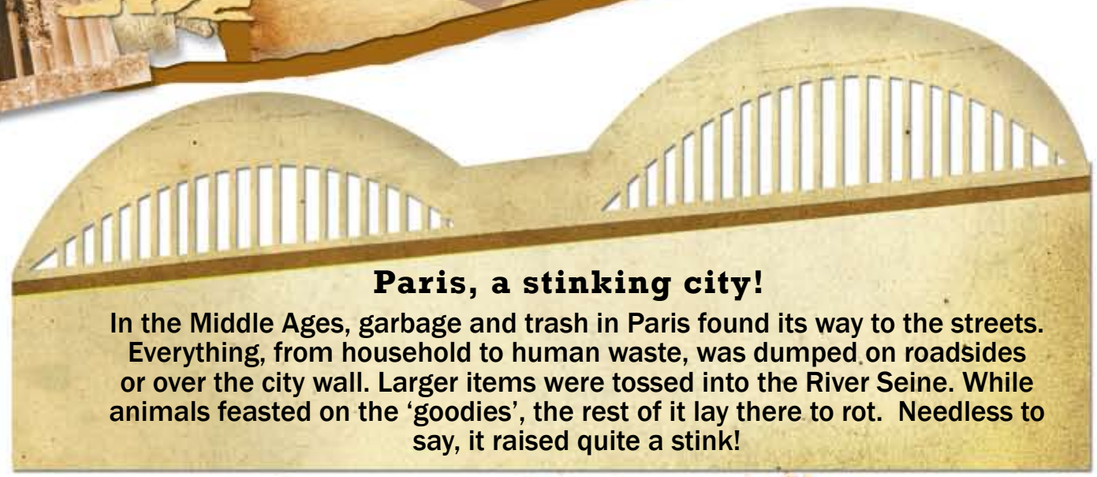
Recycling has been traced to the ancient Greek civilization. In fact the first garbage dump was set up in Athens in 400 BC. Way back in 2000BC, even people in China were practising this as a method of disposing of waste.

In AD 1031, the Japanese used waste paper and re-pulped it to make new paper. In 1690, people in America were turning cotton rags into paper, and in 1776, they melted down a statue to make bullets! However recycling really came to prominence during World War II. A lot of effort was made to recycle things due to extreme shortages of materials, especially metals. Recycling metals was seen as a task of great patriotic importance.

Happy B'earth' Day!

It was during the two world wars that the shortage of food, clothing, household items, and other essential items pushed people to choose, use, and throw things wisely.

The modern recycling movement took off in 1970. The United Nations declared March 21, the first day of spring, as the first Earth Day. John McConnell was the man who thought of a worldwide celebration for our planet, when people around the globe would come together and promise to take care of the planet.



Paris, a stinking city!

In the Middle Ages, garbage and trash in Paris found its way to the streets. Everything, from household to human waste, was dumped on roadsides or over the city wall. Larger items were tossed into the River Seine. While animals feasted on the 'goodies', the rest of it lay there to rot. Needless to say, it raised quite a stink!

All that rubbish!

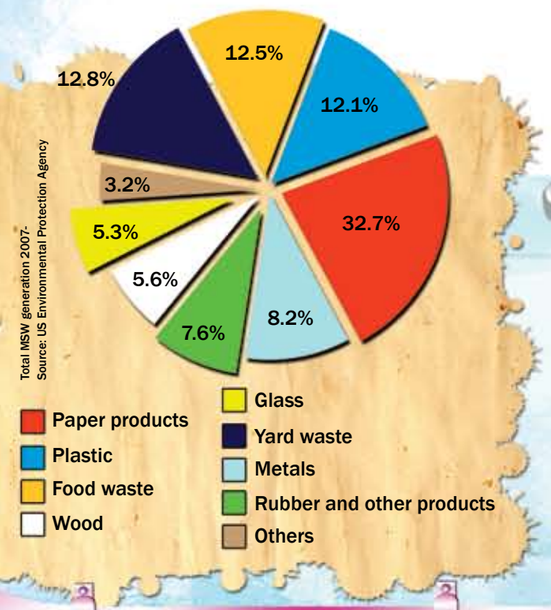
Whether you call it trash, rubbish, garbage or junk, any item that people have no use for and they throw out, is generally known as 'waste'. Waste is made up of different things. Rubbish, or trash, is the mixed waste that comes from people's homes. It is made up of food, paper, and packaging materials. Scrap and junk are metal waste. Fallen and trimmed leaves and branches from trees make up garden waste.

Where did that come from?

Waste is created by individuals, families, schools, offices, towns, cities, and countries. The amount and kind of waste that is generated by people depends on the part of the world they live in, what they buy and use, and the work they do. On an average, around the world, each person makes about two kilograms of waste per day.

Each child who takes lunch in a disposable bag to school, adds about thirty kilograms of garbage in a school year. That's probably more weight than the child can put on in ten years!

What people threw away in the US before recycling



About 8 per cent of the trash in most countries is burned in special chambers called incinerators. This reduces the quantity of waste by 60%–90%.

Solid waste

Waste from homes, businesses, and schools is called municipal solid waste (MSW). It could be a plastic toy, a metal knife or a newspaper. It could also be a worn-out belt, a juice carton, a chocolate wrapper or an old T-shirt. In countries such as the US and Australia each person creates about seven hundred kilograms of waste every year. In India, one person in a large town creates about 180 kilograms of waste every year, while in a small town, a person adds about thirty-six kilograms each year.

Only 10%–20% of the trash is recycled in countries around the world.

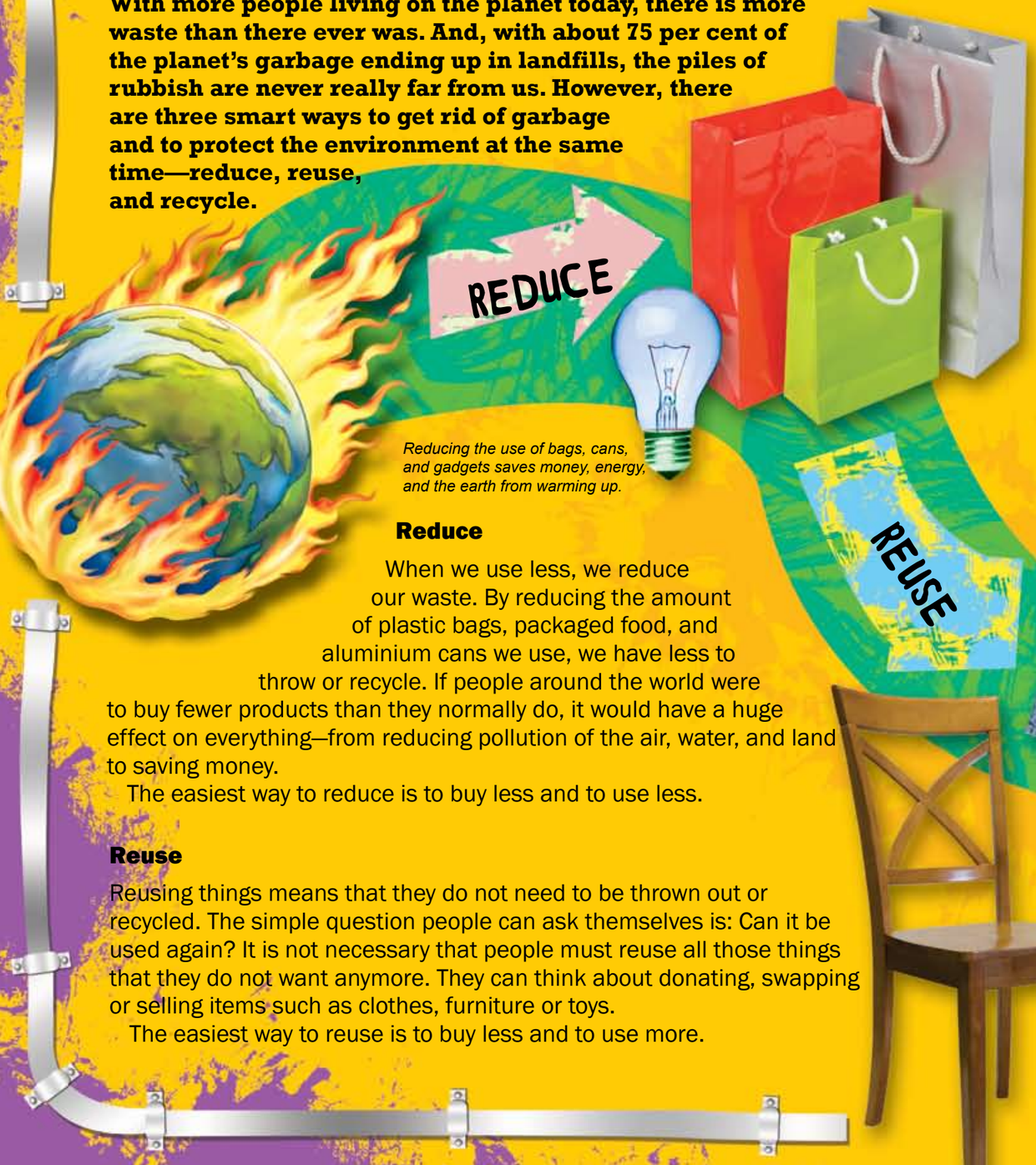
Where does it go?

Have you ever wondered where your garbage goes? Most people only want that the stinking trash leave their homes and is out of their sight. However, now it has become important for everyone who makes trash to know how their rubbish is damaging planet Earth.

In most countries, trash is either burned in an incinerator or buried in a landfill. Microbes, or bacteria, in the soil eat away the garbage and help break it down slowly over many, many years.

The three-point formula

With more people living on the planet today, there is more waste than there ever was. And, with about 75 per cent of the planet's garbage ending up in landfills, the piles of rubbish are never really far from us. However, there are three smart ways to get rid of garbage and to protect the environment at the same time—reduce, reuse, and recycle.



Reducing the use of bags, cans, and gadgets saves money, energy, and the earth from warming up.

Reduce

When we use less, we reduce our waste. By reducing the amount of plastic bags, packaged food, and aluminium cans we use, we have less to throw or recycle. If people around the world were to buy fewer products than they normally do, it would have a huge effect on everything—from reducing pollution of the air, water, and land to saving money.

The easiest way to reduce is to buy less and to use less.

Reuse

Reusing things means that they do not need to be thrown out or recycled. The simple question people can ask themselves is: Can it be used again? It is not necessary that people must reuse all those things that they do not want anymore. They can think about donating, swapping or selling items such as clothes, furniture or toys.

The easiest way to reuse is to buy less and to use more.

Recycling

Recycling involves reprocessing of materials into new ones. Milk cartons, glass bottles, aluminium cans, and newspapers are some of the materials that can and should be recycled. There are generally three levels of recycling. The first level recycles the product into a new one using the same material, for example, glass products like bottles into new glass products like containers. At the second level, old products such as cardboard boxes are turned into a different yet similar product like cereal boxes. The third level of recycling turns the discarded product into an unexpectedly new one, for example, burning old car rubber tyres to produce electricity!

Clothes, toys, and furniture that we no longer need can be reused.

Newspapers, glass bottles, and tin and aluminium cans should be recycled.

And we have just one!

In the United Arab Emirates, approximately 5.2 million plastic bags are used in Abu Dhabi alone. Most of these end up either in the sea or in the landfills. These discarded plastic bags are proving to be a silent killer for the survival of scores of marine animals in the Gulf.

Chasing the loop

The recycling logo is probably one of the most recognizable symbols around the world today. The Americans celebrated the first Earth Day in April 1970. For the event, school and college students were invited to design a logo for paper recycling. Gary Anderson's design won him the contest. His recycling symbol represented a Mobius loop that was made of three arrows in the shape of a triangle. Each arrow was drawn twisting and turning itself and chasing the other.

Symbol of meaning

The three arrows stand for the three steps that make up the recycling process. The first step is the collection of recyclable material—either from a person's doorstep or from a nearby collection centre. The collected material is then sorted and cleaned and sold to centres that make new products out of them. This is the second step. Finally, the new products are sold to people. When we buy recycled products, we close the 'loop'. This is the third step.

1 *The first step of recycling is disposal of waste and its collection.*

2 *The collected material is reprocessed into a new product.*

3 *The loop is complete when we buy the recycled item.*

Learning the loop

The original Mobius loop meant that the product had been recycled and had been made from 100 per cent waste material. Today, there are many colours, numbers, and codes that have been added to the loop. Sometimes, the three arrows are printed on a green, black or blue background or on no background at all. They can also appear with or without a circle. The arrows are also shown anti-clockwise or reversed-out. The symbol often appears with a percentage number.

The Mobius loop is supposed to be used only on things that can be recycled or that are made of recycled material. Recycling symbols are usually stamped on cardboard boxes, paper or metal products or plastic bottles and containers. These are some symbols you may see on things you buy.

The reversed Mobius loop is found on products that contain recycled material. The recycled material can be as much as 100 per cent to as little as 5 per cent recycled.

This product can be recycled.

alu

This aluminium can is recyclable.

This is recyclable steel.

100% Recycled Paperboard

This carton or box is made from 100 per cent recycled paper board.

One of a kind...we think so!

The Mobius strip has only one side and one edge! To make a Mobius strip, twist one end of a strip of paper and glue the ends together. And what good are Mobius strips? Some computer printer ribbons are in the form of a Mobius strip so that the printer can use both sides of the ribbon!

Less is more!

When people buy products, they also take home its packaging, which eventually becomes waste. A bottle of shampoo goes to the trash can after the shampoo is used up. Choosing items with the least amount of packaging or packaging that can be reused or recycled, is a smart way of reducing waste.

Prevent it!

There are many ways to reduce waste. Precycling is one of them, and it involves preventing waste even before it happens. Everyone can precycle. It can be done at school, at home, and at work. It simply requires people to think before they buy at stores.

To become 'precyclers', people must buy long-lasting and reusable items in bulk, such as buying a large pack of butter or buying a set of four soaps. Avoiding excess packaging means there is less of it to throw out.

Save it all!

Reducing waste also means saving natural resources. Using cold water for washing and bathing and fixing leaky taps saves water. Turning off lights when not needed, running dishwashers and washing machines only when full, and using compact fluorescent lamps (CFLs) and solar panels help save electricity.

Reducing waste also brings down pollution and greenhouse gases that are the major causes of global warming.

The less we use the more we save!

'Reduce' at school

Start a 'waste reduction week'.

- **Monday** *Reduction Day* – Set goals to reduce the trash at school.
- **Tuesday** *Zero-Garbage Day* – Hold a competition to see which class makes the least waste.
- **Wednesday** *Paper Day* – Use erasable boards instead of paper.
- **Thursday** *Conservation Day*– Get indoor plant saplings like peace lily, bamboo palm,fern and rubber plants for your classroom. They improve indoor air quality and reduce air pollution.
- **Friday** *Give-away Day* – Take clothes, toys, books that you do not use to school. Organize to donate these to needy charities.

Choose your buys carefully. The packaging of products such as cornflakes can be recycled.

Empty bags of chips will lie in the landfill for a long, long time.

Can you repeat that?

Plastic bags or bottles that come with our grocery, can be cleaned after use and reused to store cookies or grains in the kitchen. This would keep the plastic and glass away from a landfill or a recycling unit. Similarly rubber bands that come with sprigs or a bunch of greens can be used over and over again. Finding repeated use for things helps reduce waste.

Reuse before recycle

Recycling involves collecting, sorting, and processing things into new products. This process needs money and uses transport, which adds to pollution. On the other hand, using an old teapot as a flower vase is 'reusing' just as much as saving wrapping paper from a gift to pack a present later. This type of reuse saves money and natural resources because the item does not need to be recycled.

Again and a 'gain'

Products can be reused for the same purpose. Plastic bags can be saved to be used later. In countries such as India and Pakistan, soft drink bottles are collected after use and refilled to reduce costs of production. Sometimes, when furniture, toys, shoes and gadgets are damaged, they can be reused after repair. This too helps save energy. Fix it, so you can use it!

Disuse to reuse

One person's disuse can well become another one's reuse. Hangers from dry-cleaners can be returned to them. Selling or donating books, appliances, clothes, and sports equipment earns money for people who give and saves money for those who take. Exchanging items with neighbours and friends also helps people who could use things that others do not need. Yet, it is best to reduce first and keep reuse as a second option.

Same but new

Old tyres can be turned into boat fenders, steel drums can be used as feeding troughs for livestock, and torn clothes can be made into cleaning rags. 'Kabadiwallas', or scrap collectors, in India buy paper that is used for repackaging or recycling. Countries like Jordan, Kuwait and UAE which have a shortage of fresh water, treat and reuse waste water in fields, parks, fountains, car washes, and factories.

Reusable items

Shopping bags can be reused to line your waste bins. They can be reused as long as wet things are not discarded in it.

The white plastic tray in which food is packed and sold can be collected and reused for mixing paint in your art class.

By sticking labels over the address you can reuse envelopes. Old envelopes can be used as scrap paper to make notes on.

By cleaning glass jars and small pots, you can use them as small containers to store odds and ends.

Newspaper, cardboard, and bubble wrap make useful packing material when moving house or to store items.

Packaging such as cardboards, foil, and cartons can be donated to schools, where they can be used in art and craft projects.

Scrap paper can be used to make notes and sketches. Don't forget to recycle it when you no longer need it.

Husk and save water!

Turkish scientists have found that the peanut husk can remove 95 per cent of the copper ions from waste water, thereby cleaning it and improving its quality. This reuse of the husk and waste water will help reduce land and environmental pollution. And, this reuse will cost peanuts!

Reasons to recycle

Reusing things does not, and cannot, completely make waste disappear. Neither can recycling, but it can prevent things that we no longer need from ending up in a landfill. Recycling is actually cheaper than dumping trash in landfills, rivers or oceans, and there are four good reasons to recycle.

Saves energy

Energy is used to make new items. When products are recycled, energy is saved. It takes 95 per cent less energy to recycle aluminium cans than it does to make new ones. One recycled tin can saves enough energy to run a television for three hours. One recycled glass bottle saves energy sufficient to run a computer for twenty-five minutes.

Saves natural resources

Natural resources such as water, trees, metals, and fossil fuels come from the earth. Paper is made from trees, plastic is made from oil, and cans are made from metal. Each time people throw away paper and cans they also waste the planet's natural resources.

Recycling can save plastic and metals from landing up in our oceans and beaches.

Recycling products uses less of the planet's natural resources.

Recycling one plastic bottle saves enough energy to light a sixty-watt bulb for three hours!

Recycling helps birds and fish breathe easier as it lessens air and water pollution.

Up to 60 per cent of the rubbish that ends up in the dustbin can be recycled.

Saves landfill space

Landfills take up a lot of space. This space can be used for other useful purposes or even left untouched for animal habitation.

Most families throw away an average of between twenty and forty kilograms of plastic each year which can, otherwise, be recycled. Plastic can take up to five hundred years to decompose or break down. When items get recycled they do not go to landfills. This saves landfill space and reduces the need for them.

Saves air and water from pollution

When clothes, shoes, computers, furniture, and other products are made, the factories where they are manufactured emit greenhouse gases. Waste from factories is also dumped into rivers and oceans. This pollutes both air and water and is one of the known causes of global warming. Air is also polluted when garbage is burned.

However, factories that make recycled aluminium products cause 95 per cent less air and water pollution compared to factories that use fresh natural resources to manufacture them. Paper mills that recycle paper cause less water pollution than factories that make paper from scratch.

If you must throw out something, recycle it!

What about you?

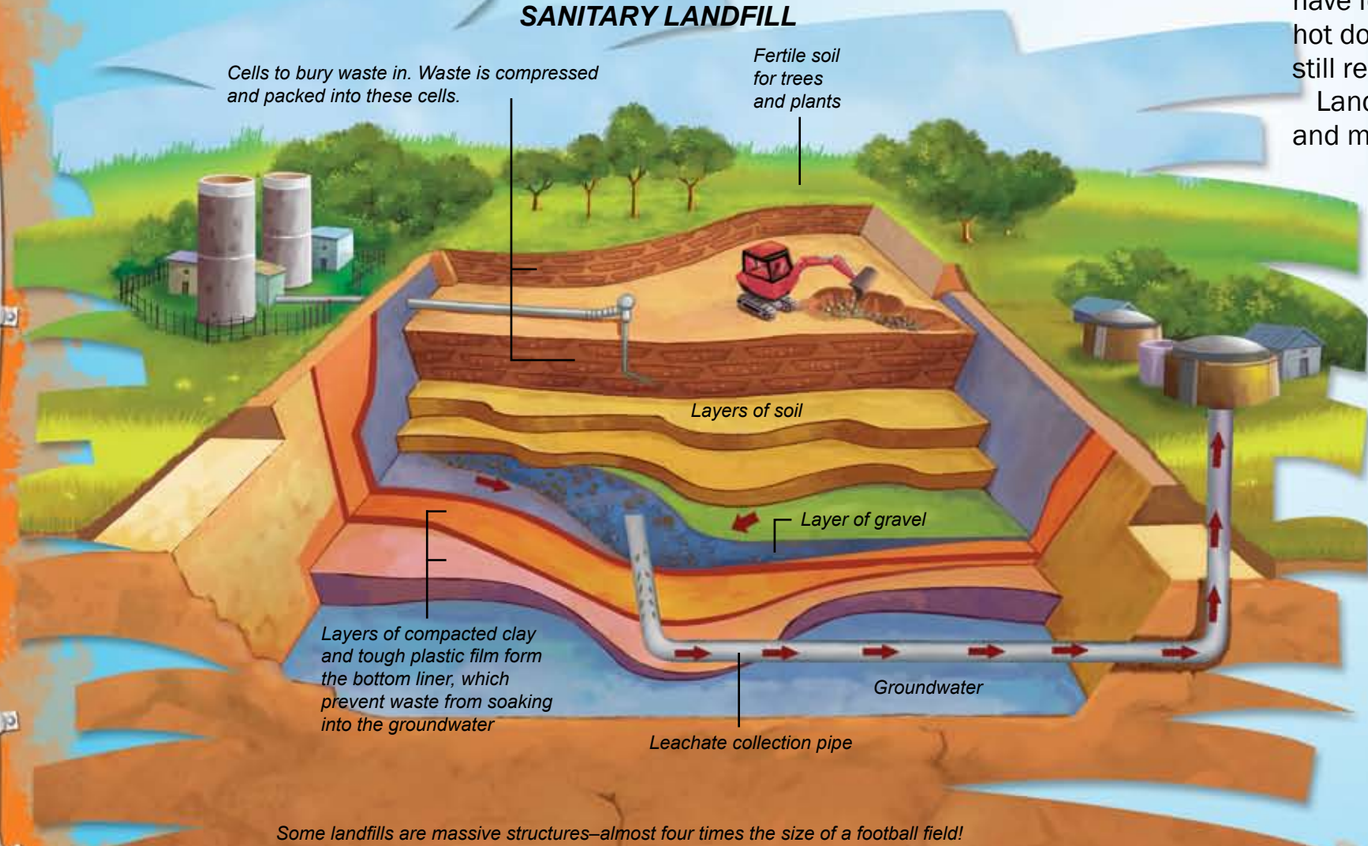
How much recycled paper do you use? How many glass bottles do you recycle? How many tin or aluminium cans do you recycle? Make a note of what you recycle in a month to know your savings.

What filling does this have?

Where on the earth, even after fifty years, would you find a shower cap that you can use; a glass bottle that is still intact; and a newspaper that is almost entirely readable? A landfill, of course!

Not quite pits!

Landfills are large open grounds, far away from cities, where waste is dumped. Landfills used to be mountains of trash, but today, they are well-designed pits that keep the garbage dry. A basic landfill is an enormous pit that is dug up and lined with thick plastic and clay, which stops water or trash from leaking into the ground. Garbage is not just simply tossed into a landfill. It is offloaded in old and new sections of the landfills. It is then covered with dirt everyday. Garbage rots very, very slowly here.



Some landfills are massive structures–almost four times the size of a football field!

Airy and non-airy landfills

Most countries around the world use 'sanitary landfills'. Garbage is squeezed and packed together, and when tonnes of it piles up, no air or oxygen can pass through it. The garbage then starts to produce greenhouse gases, methane and carbon dioxide. When rain falls and mixes with the garbage, the liquid turns into leachate, a poisonous substance.

Bioreactor landfills are now being tested in developed countries such as the US and Canada. Air and water are passed through the garbage in a controlled way in these landfills to help waste decompose, or rot, faster. The gases produced are used to make electricity.

What's wrong with landfills?

In most landfills, air barely reaches the bottom layers and trash rots very slowly. Scientists from the University of Arizona studying landfills have found twenty-five-year-old hot dogs and grapes that were still recognizable!

Landfills are expensive to build and manage. Even after a landfill is full and not in use, it has to be monitored for years.

The two biggest problems are leakages of methane and leachate. Some landfills, especially the older ones, burn the methane gas to get rid of it. When methane is burned, it destroys the ozone layer in the atmosphere. Methane is also dangerous because it can explode easily.

When leachate leaks into the groundwater and soil, it pollutes them. This can make people seriously ill.

Make your own mini landfill and an open dump

Take

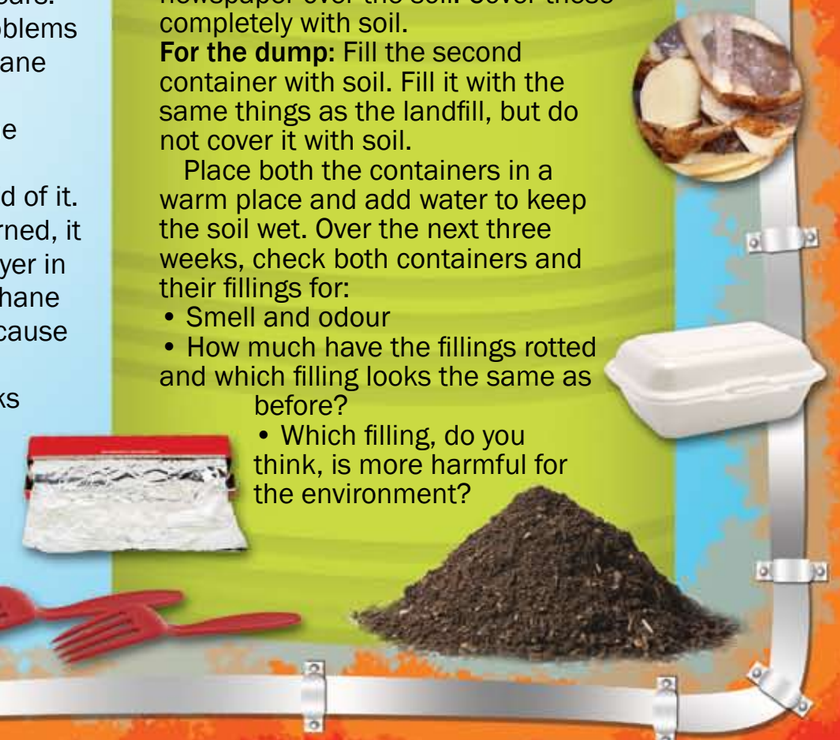
- Two large containers
- Fruit or vegetable peels
- Small pieces of plastic (for example, fork), glass, aluminium foil, styrofoam, and other wastes
- Small pieces of newspaper
- Soil

For the landfill: Take a container and spread a layer of soil in it. Place peels, plastic, foil, styrofoam, and newspaper over the soil. Cover these completely with soil.

For the dump: Fill the second container with soil. Fill it with the same things as the landfill, but do not cover it with soil.

Place both the containers in a warm place and add water to keep the soil wet. Over the next three weeks, check both containers and their fillings for:

- Smell and odour
- How much have the fillings rotted and which filling looks the same as before?
- Which filling, do you think, is more harmful for the environment?



Is the hazard sign up?

Is your house dusted, mopped, and swept regularly? Is your house spotlessly clean? Do you think your house is free of dust and germs? Even if your answer is 'yes', you should know that you have 'hazardous', or dangerous, products sitting in your kitchen cupboards and bathroom cabinets—some of which you use almost daily!

Know your waste

If it's hazardous, or toxic, waste it must be an oil spill in ocean waters, right? Wrong! The truth is that much of this waste comes from things we use in our homes!

Many household products contain chemicals that make them corrosive, flammable, and/or toxic. Petrol and paint are flammable. They can catch fire easily. A corrosive item, such as acid, can eat through metal and human skin. Chlorine and ammonia are reactive materials that can explode easily or turn into a poisonous gas when mixed with other chemicals. Weed killers are toxic because they can cause illness, and even death, in humans and animals. When these products are no longer needed, they make hazardous waste.

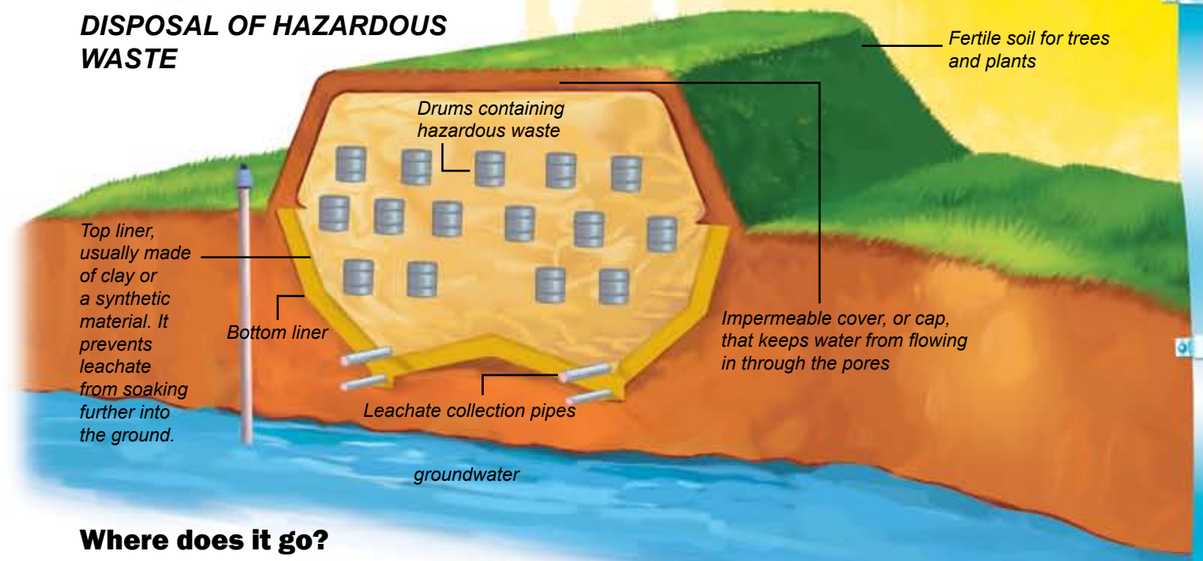
Factories that make pesticides, leather, paper, textiles, and building materials also produce hazardous waste.

Some hazardous products such as bathroom cleaners, oven cleaners, room fresheners, toilet bowl cleaners, and laundry detergents are commonly used in households.

Replace your hazards

- Use baking powder to clean greasy cooking pans.
- Toss out those mothballs and use dried margosa leaves or cedar tree shavings to keep away insects from clothes.
- Sprinkle eucalyptus seeds and leaves around your pet's mattress to keep fleas away.

DISPOSAL OF HAZARDOUS WASTE



Where does it go?

Hazardous waste can be reused and recycled at special facilities. It is also stored in specially built ponds, burned, and sent to hazardous waste landfills. This waste can be managed only when people do not mix it with their household garbage or trash or pour leftovers down the drain.

Toxic waste also becomes a problem when it leaks from landfills into the ground, catches fire while being transported, or is sneakily dumped at a place not suitable for it. When chemicals from this waste leak into the groundwater or air, they can poison the food we eat and the air we breathe.

Paint, paint thinner, varnish, and glue add to household hazardous waste.

Hazards checklist

These are some of the products that need to be disposed of carefully.

- Electronics: telephones and radios
- Batteries: AA, AAA, C, and D cells
- Musical greeting cards
- Thermometers
- Disposable diapers

At home with recycling

Practicing the three Rs at home can be fun and exciting. The only tools you need are a caring heart and a thinking mind. Make more with less and use less to make a big difference to planet Earth.

Cupboards

- Paint, decorate, repair or donate shoes. Some shoe brands accept used shoes and reuse them to make surfaces for tracks and courts!
- Donate clothes, pass them on to siblings or make quilts, cushions or cleaning rags.

Lights

- Switch off lights when not needed.
- Use compact fluorescent lamps (CFLs) to save energy.

Taps

- Turn off taps while brushing your teeth. Use a glass of water when rinsing your teeth.
- Wash clothes in cold water. Air-dry and sun-dry them wherever possible.
- Use the energy-saving settings on your dishwasher and let dishes air-dry.

Garage

- Recycle the metal parts of a bicycle. Handle-bars, chains, inner tubes, and seats are useful for artists and designers.

Living room

- Clean, repair, or donate carpets. Cut them up into floor mats for the home or car. Use as compost bin cover in winter.

Study

- Use newspapers and magazines to wrap presents. Recycle the rest.
- Turn off the computer when done. The ‘stand-by’ mode uses electricity.

- Donate books to a charity or library. Sell them online. Books cannot be recycled because they are bound by glue.
- CDs: Recycle or cover with felt and use as coasters. Make a wind chime with old CDs. Hang them from plants to keep birds away.
- Recycle envelopes, junk mail, catalogues, and coloured paper.

Kitchen

- Wash dishes in cold water.
- Use egg shells for composting.
- Place leftover seeds and bread crumbs in the garden as bird food.
- Reuse plastic and glass bottles as containers. Recycle what is not needed.
- Wash fruit and vegetables and rinse dishes in a plugged sink or bowl instead of under running water.
- Use reusable grocery shopping bag.
- Buy cereal boxes and juice cartons in bulk to reduce buying more packaging.
- Use cleaning cloths instead of paper towels.

Garden

- Wash vehicles, outdoor furniture, and the family pet on the grass – this will water your lawn.
- Use a trigger nozzle on your garden pipe. Add compost instead of fertilizers to grass and potted plants.

Composting with Crawlies

In forests, leaves, fruits, flowers, and seeds from trees fall to the ground and rot on their own. They turn into compost, which helps plants to grow. This happens all the time and without the help of humans. Nothing is wasted and everything is recycled back to nature. In cities, people make more waste than nature can manage. But with a little help from human hands, waste can be turned into rich soil. Composting is a cheap way to reduce and recycle waste to make natural nutrition for soil.

How it works

Compost is made when different kinds of living creatures such as worms, beetles, insects, bacteria, and fungi feed on waste. It needs air, water, carbon, and nitrogen. Carbon is found in 'brown' materials such as dry leaves, straw, wood chips, and cardboard. 'Green' materials contain nitrogen gas, which is found in living things like grass, plants, and vegetables.

Take leftover food, fallen leaves, and newspaper shreds. Mix them together, and soon you will have compost.

Green, leafy material form the top layer in a compost pit.

Dry, brown material form the bottom layer.

Throw in some earthworms to speed up the process.

When these ingredients are mixed in the right quantities in a pile or a container, the waste begins to rot. Too much of green material can turn the pile smelly. Too much of brown material can make the pile rot very slowly. The waste pile will turn into compost over a period of time even if it is not checked. The heat from the sun and air are all that are needed. However, if the pile is stirred from time to time it will rot faster. Finally, the waste will turn into a sweet-smelling humus, or compost.

Bake a compost cake

Ingredients

Kitchen waste – vegetable and fruit peels, egg shells, tea bags, and so on

Garden waste – hay, grass, ash, sawdust, wood chips or straw

Worming it indoors

Compost can also be made using worms. This is called vermiculture and it can be done in small spaces using just a container. This can easily be done in a less spacious urban apartment. A compost bin under the sink is all that you need. Not only will it take up little space in your apartment, it will also allow you to make compost from all the food scraps and the kitchen waste. This will turn into a rich, organic fertilizer and be used as manure for your potted plants.

Food for the 'soil'

Compost is a health food for grass, plants, and soil. Chemical fertilizers have to be used in the right quantity so that plant roots do not burn. That is not a problem with compost. The soil can take in and use as much as is put into it.

METHOD:

1 *Take a composting bin and add kitchen and garden waste.*

2 *Spread soil over this layer of waste. Bugs and insects in the soil start to feed on the waste.*

3 *After a few days, check the waste pile. If it looks soggy, add straw or saw dust. It if looks dry, add water. The pile should feel like a squeezed-out sponge.*

4 *Mix the compost from time to time. This will help it bake faster.*

5 *When the pile shrinks in size, it means it is baking well.*

6 *The compost is ready to use in one to twelve months. When it turns dark and crumbly and begins to smell sweet, it is ready to use.*

Three Rs at school

Learning to do what is right for the planet is as important as going to school. And, practicing the three Rs at school is as simple as learning the alphabet! Saving energy, money, and the earth are all worth your time and effort.

Going to school

Use the school bus or car pool with friends to reduce air pollution and save fuel.

Plastic bags

Recycle. Cut into one-inch strips and join to make yarn. Knit a new, stronger plastic bag. About sixty bags make a new one.

Printer cartridges

Refill them. Many manufacturers collect old cartridges and pay money.

Cafeteria

Place a recycling bin and a composting bin. Food waste can be used for composting.

Shredded paper

Avoid shredding. If it must be done, then use the shreds in a compost bin to absorb water in a soggy pile.

Stationery

Buy long lasting plastic folders instead of paper ones.
Buy refillable items like pens and pencils.
Put notices on bulletin boards instead of making paper copies.

Cardboard boxes

Reuse for craft projects. Collect and store recyclable items in them.

Recycling bins

Place separate recycling bins for paper and metal and throw trash in the correct bins.

Paper sheets

Use both sides of the paper. Use scrap paper for taking notes.

Celebrate an Eco-Day

Fix one day in a month to clean up litter. Learn about reusing materials, reducing waste, recycling, and composting.

Books

Cover school books with cut-up brown paper bags or newspapers. Decorate creatively.
Pass on used textbooks to junior students.
Donate your story books to the school library.

Art class

Use non-toxic vegetable-based inks and water-based paints.
Have a creative art sculpture lesson. Use recyclable items such as plastic bottles, wood, paper, hangers, and containers.

Classroom

Switch off lights and fans when not in use.
Set up a reuse box in the classroom for pencils, pens, folders, and other items that are still usable.

Waste-free lunch championship

A lot of garbage in schools is made during lunchtime. Disposable water bottles, paper napkins, and plastic cutlery form some of this waste. Hold a competition to find out who makes the least waste from their lunch.

A sample of a waste-free lunch

- Sandwiches and other food in reusable containers
- Whole fruits without packaging and snacks in reusable containers
- Drinks in containers that can be reused, such as a thermos
- Reusable forks, spoons, and cloth napkins

Eee-ks waste!

When electrical and electronic gadgets such as computers, televisions, DVDs, cell phones, and refrigerators are trashed, they make up e-waste.

In European countries and the US, e-waste makes up 1 per cent of the total solid waste, and by 2010, it will grow to 2 per cent. In the European Union, each person makes about fourteen to fifteen kilograms of e-waste every year; in China and India, it is less than one kilogram per person in a year.

Is it all waste?

By the end of 2007, we had made forty million metric tonnes of e-waste, which could fill up a line of trucks, bumper to bumper, halfway around the world! So, you may wonder, where does all this waste go?

In many countries, e-waste ends up in landfills. In Hong Kong, 10%–20% of old computers go to a landfill. E-waste is also taken apart and burned to get metals, such as copper, from it. It is also sold to be dumped in other countries.

My trash is your trash

Up to 80 per cent of the US's e-waste, which can be recycled, is sent to China, Nigeria, India, and Pakistan. The US would have to spend twenty-five dollars to recycle a computer, whereas sending it to India costs only two to three dollars.

Isn't that a good thing?

If all the e-waste that is exported by the US and European countries were recycled, it would be good for our planet. But this is not what happens. In Guiyu, China, piles of e-waste clog the Lianjiang river. In Accra, Ghana, e-waste from the US and China is ripped apart for its useful parts and the rest is burned or dumped.

Dumping, burning, and even stripping e-waste for their parts is harmful to humans and the environment. The chemicals from e-waste enter human bodies, water, soil, and air and are known to cause diseases like cancer.

E-waste excess

People in Asia trash twelve million tonnes of e-waste every year, and India makes 146,000 tonnes of it. By the end of 2009, it is estimated that UAE would generate e-waste to the tune of 29,000 to 38,000 tonnes .

It's all coming back...recycled!

Once paper, aluminium cans, glass, and plastic are trashed in recycle bins they are taken to recycling centres. It is there that the recycling process begins.

Glass – see through recycling!

Glass is separated according to colour.

It is then taken to a glass unit, where it is cleaned. It is crushed into small pieces called cullet.

The cullet is mixed with sand, soda ash, and limestone. This mixture is heated and turned into a liquid.

The liquid is poured into moulds to make new glass products such as bottles, floor tiles, kitchen counters, and even glassphalt for road surfaces.

Aluminium – you can!

Aluminium cans are taken to a recycling plant.

They are shredded and melted in giant furnaces.

The melted aluminium is cooled and shaped into a block called ingot.

The ingot is turned into sheets that are then sent to factories that make cans, foils, furniture, and more.

Paper – don't write it off!

Paper is first sorted. It then goes to the paper mill, where it is turned into pulp by running it through water and some mechanical processes.

Air bubbles are passed through the pulp, which help remove the ink. It is then soaked in chemicals to remove glue and other dirt.

The pulp is beaten and then fed into a machine that rolls out sheets of paper, which are dried before they can be used.

The recycled paper is made into newspapers, magazines, printing paper, cardboard, and toilet rolls.

Plastic – long live plastic!

Plastic bottles and containers are sent to a facility where they are washed and checked.

The plastic is cut into tiny pieces that are melted into liquid in a furnance. The liquid is then turned into long strands.

The strands are cut into pellets, which are sent to factories to make new items.

Recycled plastic is turned into the most imaginative products—tables, chairs, stationery, and packing material.

What's recyclable and what's not

There are many things that you can recycle. Some of these things may need extra effort to get them to their correct recycling centre, yet for our planet's sake it is all well worth it.

Batteries

Primary batteries such as those used in radios, toys, cameras, torches, watches, computers, calculators, and hearing aids cannot be reused. Secondary (rechargeable) batteries, which are used in camcorders, portable radios, laptops, mobile phones, and remote-controlled toys can be reused. The bad news is that most household batteries end up in landfills because people cannot identify the different battery types to recycle them accordingly.

Those that are marked as nickel cadmium (Ni-Cd), nickel metal hydride (Ni-MH), lithium ion (Li-ion), and small sealed lead (Pb) are recyclable.

Plastics

Plastic bottles are labelled with a number that stands for the material they are made of. Bottles numbered one, two, three, four, five, and seven are usually containers for soda, cooking oil, milk, and detergent. These are recyclable. It is very difficult to recycle polystyrene found in bottles that are numbered six.

...and many more

Cell phones, old computers, fluorescent bulbs, used motor oil, aluminium and steel cans and containers, tyres, wood, plastic bags, paint, building materials, cardboard egg cartons, empty aerosol cans, tissue boxes, and wrapping paper are some of the many things that can be recycled.

PLASTICS CODES

1	2	3	4	5	6	7
■ Soft drink bottles ■ Water bottles ■ Shampoo bottles ■ Peanut butter jars	■ Milk, water, and juice bottles ■ Detergent containers ■ Grocery bags	■ Clear food packaging ■ Shampoo bottles	■ Breads bags ■ Frozen-food bags ■ Squeezable bottles of mustard and ketchup	■ Ketchup bottles ■ Yogurt cans and margarine tubs	■ Egg cartons ■ Cups and plates	■ Ketchup bottles ■ Juice bottles

Closing the loop

A circle has no beginning and no end, and all the points on its path must meet to complete it. The recycling loop is much the same. In order for all of its points to meet, people need to recycle, as well as buy recycled things. Just reducing, reusing, and recycling is not enough. After a product is recycled, people must choose to buy it over products that are not.

When things are recycled, far less waste is generated and there is very little pollution.

In good shape!

When people buy recycled items they make a huge contribution not just to the planet but also to other human beings.

Water, land, minerals, and forests are the earth's limited natural resources. Some of our resources like oil and coal, once used, can never be replaced again. Each time a product such as furniture, paper, and glass bottles is made, natural resources are used up. Buying recycled products means saving resources and energy. And, resources saved are resources earned!

The waste that is created when things are made from scratch goes into the ground, water supply, air or landfills. For every fifteen thousand tonnes of waste that is sent to landfills only one job is created for people. However, when that waste is recycled, it gives a chance to nine people to earn a living.

Recycled products look just as good as the non-recycled ones and are just as hardy and durable.

Affordable and available

Many people believe that recycled products are more expensive. That might have been true some years ago, but today, recycled products are affordable and easily available. In fact, most cereal boxes are made from 100 per cent recycled paper; they are grey in colour on the inside.

Whether people can tell or not, hundreds of things in their homes, schools, and at work are made from recycled materials. Some of the things you would never expect to see recycled into are: fleece jackets from plastic bottles; mouse mats from rubber tyres, pencils from plastic cups and even teddy bears from 100 per cent recycled knitwear.

Telephone directories can be recycled into sleeping bags!

Caution!

Sometimes, recycled items may have poisonous materials, which could be harmful for our health. A common example is water containers. Recycled plastic cans may contain some toxic elements that may pass on to the water over a period of time.

Recycling around the world

Scandinavian and north-western European countries recycle the most. Overall, Sweden, Finland, Norway, Holland, Denmark, Austria, Switzerland, Germany, France, and Japan have the highest recycling rates.

US

Today, the US recycles 42 per cent of all paper, 55 per cent of all aluminium beer and soft drink cans, 57 per cent of steel packaging, and 52 per cent of all major appliances. This has more than doubled in the last fifteen years. Of course, the amount of recycling in the US differs from state to state. Alaska recycles less than 9 per cent of its waste, while New York recycles 40 per cent.

The US recycles 40 per cent of all plastic soft drink bottles.

Europe

The Swiss do not just throw things away. They reuse and recycle them. They have to. And, they have to pay for some of it! Although recycling is free, rubbish bags that are collected from homes must have a sticker, which costs one Euro. If the rubbish does not have a sticker, the rubbish rots at the person's doorstep. Switzerland recycles 91 per cent of its drink cans. It recycles 80 per cent of its plastic containers, which is more than Europe's average 30 per cent!

If it's Germany, it must be eco-friendly. Recycling in Germany is a very complicated activity. People tend to look out for items with the Green Dot, which simply means that the manufacturer has to pay for packaging. Green Dot products have less paper and metal and use thinner glass. Recycle bins are colour-coded brown, grey, black, yellow, and green. If things are not in the correct bin they could land up getting burned in the incinerator, which could give out poisonous gases.

Spain can easily be called the leader of glass recycling. The law in this country puts the responsibility of recycling on companies that sell their products in glass containers. Companies have to pay for the collection, sorting, and recycling of their bottles.

Germany produces thirty million tonnes of garbage every year. Of this, 50 per cent is made up of household waste.

Fact box

London is now the first city in Europe to run a hydrogen bus fleet. Ten buses will be powered by hybrid engines, making them not just quieter, but also pollution free.

Circle of life

Every product, when made, uses natural resources of the environment like water, minerals, land, and so on. Every product has a life from the moment it is created. That is the beginning of its life cycle. When the user does not need it anymore, or when it stops working, the product's life cycle comes to an end.

Cell phones: Not a happy ring to it!

People generally change their phones every eighteen months. Not many people may know that making more cell phones means hurting the environment and also gorillas. Cell phones are made up of a mineral called coltan, which is found in the Congo, which also happens to be the habitat of gorillas. Mining for this mineral means cutting down trees and forests where gorillas live.

Learning about the cell phone's life cycle may make you think about the energy, money, and resources that go into making it. Think about giving 'reuse, reduce or recycle' a chance before you throw it in the trash.

Life cycle of a cell phone

1. Gathering the material

A cell phone is made from minerals and materials that are obtained from the earth, for example, nickel, cobalt, zinc, cadmium, copper, and lithium metallic oxide among others.

These parts are made in factories all over the world.

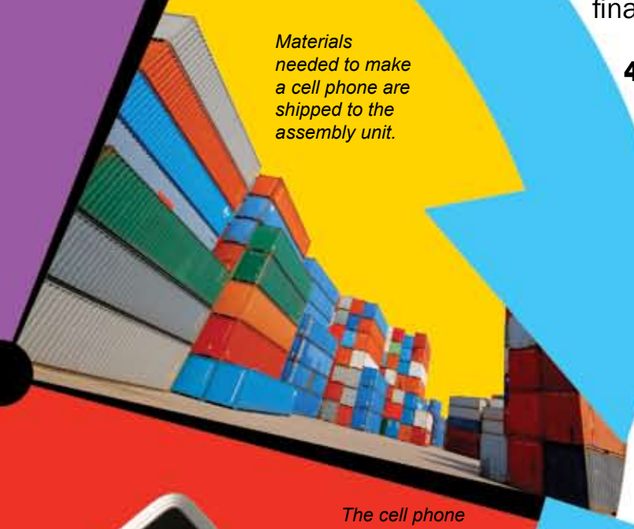
Parts of a cell phone: case, LCD display, wiring board, plastic keypad, microphone, speaker, antenna, battery, SIM card, and adapter

2. Preparing the materials

The materials needed to make a cell phone are extracted from the earth treated, prepared, and shipped to parts of the world for assembly.

3. Putting the materials together

Electricity, crude oil, plastics, fibreglass, and glue are only some of the things needed to put the cell phone together. All of these materials are sourced and treated in different places and, finally, transported to the assembly unit.



Materials needed to make a cell phone are shipped to the assembly unit.

4. Getting the cell phone to the store

Plastic and cardboard packaging boxes that are made in other parts of the world are shipped to the factory where the cell phones are assembled. Once packed, the cell phones are again shipped to different countries from where they are sent by road or rail to stores in different cities.

The cell phone reaches the consumer after being shipped from factories and transported to stores.

5. Using the cell phone

People buy and use the cell phone. The packaging is trashed.

6 . Getting rid of the cell phone

Cell phones are either reused by another person or stay unused with the owner. Often, they end up in landfills.

There are approximately two cell phones being used by a single person in the United Arab Emirates.

Get 'loopy'

Collect all the scraps of paper, including newspaper that you do not need. When you have a boxful, you can recycle the paper at home and complete the loop, that is, by using recycled items.

What you need

● Sheets of used paper or newspaper ● Large square pan, about three inches deep ● Three cups of water ● An empty bottle ● A large bowl

1 Tear the paper into small pieces.

2 Put the paper pieces into the bowl. Add water, a little at a time.

3 Mash the mixture into a pulp. Add water and paper till the mixture looks like a thick paste.

4 Take the pan and turn it upside down. Take a handful of the paste and spread it evenly on the upturned pan.

5 Cover the spread with a few sheets of newspaper.

6 Place one hand on the top of the pan, and carefully, turn it upside down on a table.

7 Lift the pan. The paste will stick to the newspaper.

8 Cover the paste with a few sheets of newspaper.

9 Take the bottle and hold it like a rolling pin. Flatten the paste with the bottle and press the top sheets of newspaper to blot the water from the paste.

10 Remove the top sheets of newspaper and let the paste dry completely.

11 Once dry, the 'new' paper will peel off from the newspaper below. Your recycled paper is ready to use.

Recycling paper and your eco-savings

Energy: It takes 64 per cent less energy to make paper from used paper than from trees. Recycling one tonne of paper saves the equivalent of more than 260 litres of oil.
Water: It takes 61 per cent less water to make paper from 100 per cent recycled materials.
Land: Every tonne of paper that is recycled saves three cubic metres of landfill space.
Air: Making recycled paper gives out 70 per cent lesser air pollutants than making paper from trees.

Glossary

Bioreactor— a chamber or device in which organisms break down waste (as in landfills) or make useful substances

Carbon— an element found in rocks, carbon dioxide, rivers, lakes, trees, and some animals

Compost— a mixture of rotting matter that is later added to soil to make it richer

Corrosive— capable of destroying

Crude oil— raw petroleum as it comes from the ground

Fertilizers— food for plant growth

Flammable— easily set on fire

Fossils fuels— coal, petroleum, and natural gas, which are dug out from the earth and used as fuel

Furnace— a closed box or chamber in which heat is produced

Glassphalt— road-surfacing material made of asphalt and crushed glass

Global warming— an increase in the earth's average temperature

Incinerator— a furnace that burns garbage to ashes

Landfill— land where trash and garbage is dumped

Litter— scattered rubbish

Leachate— liquid waste in a landfill

Microbes/bacteria— very, very tiny living thing

Methane— a colourless and odourless gas used as fuel

Municipal solid waste— unwanted litter or rubbish from homes, businesses, and schools

Nitrogen— a colourless gas present in the atmosphere

Non-recyclable packaging— packaging that cannot be reused and lands up in landfills, some of which takes 450 years to decompose

Non-renewable— something that cannot be replaced after it is used

Omnivores— living beings that eat both plants and animals

Pharmacy— a store that sells medicines

Pollutant— something that dirties the air, water or land

Polystyrene— clear plastic or stiff foam

Precycling— reducing waste by buying in bulk to reduce packaging, buying recyclable things and packaging, avoiding junk mail etc.

Recycling— treating waste to make usable products

Recycling centre— a place where people can take recyclable material like paper, aluminium can, and glass bottles and get money for it

Reducing— using less of something

Reusing— using or finding use of something over and over again

Re-pulp— adding water to paper to make a smooth mixture

Resource— a source of supply or materials

Silica— a mineral present in sand

Swapping— making an exchange

Symbol— is a word, phrase or image that represents or stands for something

Toxic— having a poisonous effect

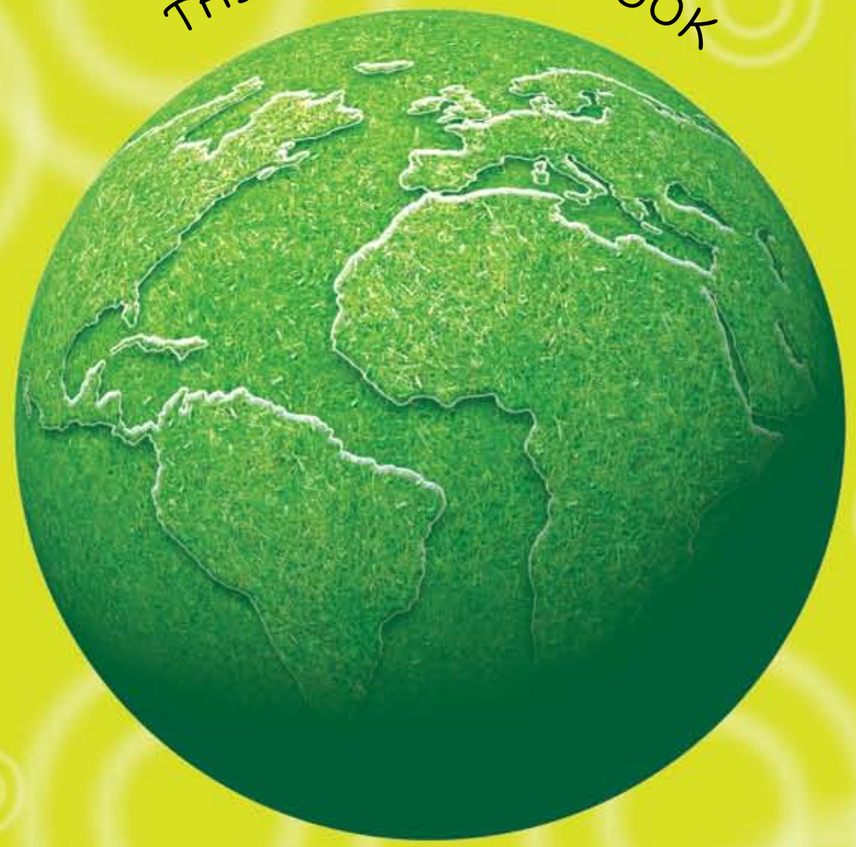
Vermiculture— using earthworms to turn kitchen waste into compost

Waste— unwanted litter or rubbish

Watt— a unit of power

Index

THIS IS A GREEN BOOK



First published in 2008
Reprinted in 2009

TERI (The Energy and Resources Institute)
Darbari Seth Block, IHC Complex, Lodhi Road, New Delhi - 110 003, India
Tel. 2468 2100/4150 4900, Fax: 2468 2144/2468 2145
India +91 ▪ Delhi (0)11
Email: teripress@teri.res.in ▪ Website: http://bookstore.teriin.org

Adapted for UAE by Environment Agency, Abu Dhabi

ISBN 978-81-7993-145-5

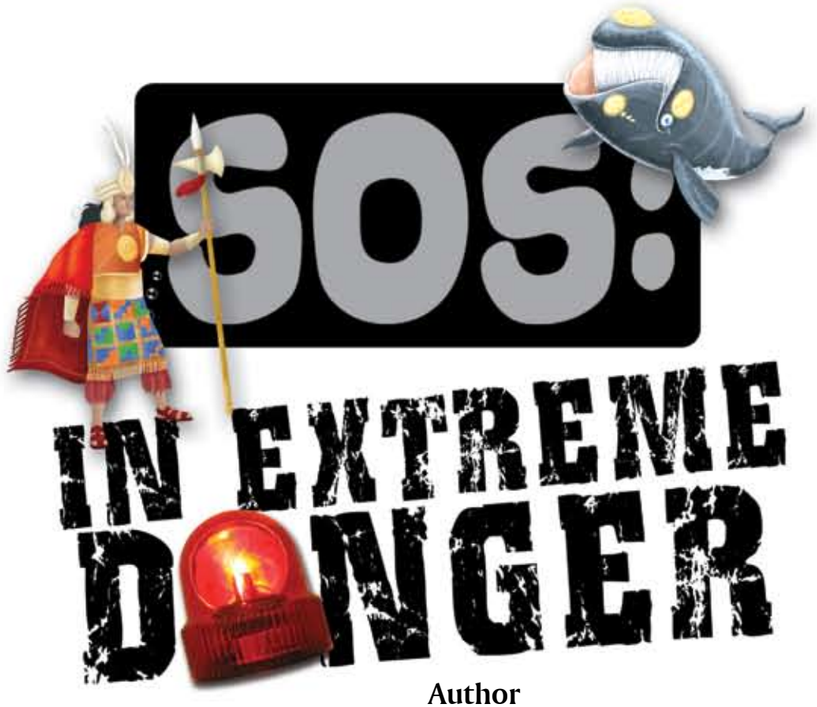
Adaptation Material : Environment Agency, Abu Dhabi
Managing Editor: Madhu Singh Sirohi
Series Editor: Pallavi Sah
Art Direction and Concept: Priyabrata Roy Chowdhury
Illustration: Rajesh Das and Yatindra Kumar

PICTURE CREDITS
32-33 Chinguetti Mosque: Maggie Dwyer

Printed and bound in India

This book is printed on recycled paper

SAVE PLANET EARTH



SOS: IN EXTREME DANGER

Author
Benita Sen

Terrapin

Note from Mr. Majid Al Mansouri

It is He, who made you trustees of the earth,
And exalted some in rank over others.
In order to try you
By what He has given you
Indeed your Lord's retribution is swift
Yet He is forgiving and kind.

Verse from Holy Quran –Surat Al Ana'am

Ayah 165 (6:165)

Climate change today is threatening our planet and in fact our very survival on earth .All countries and governments are concerned as we humans have contributed to this malaise. To find solution to any problem, we must first fully comprehend it. Hence Environment Agency – Abu Dhabi (EAD) in association with The Energy Research Institute (TERI) is adapting and bringing this save planet series of books on Climate change to children in the UAE with a hope that students as future custodians of our environment learn about what ails our mother earth, how each one us impact the environment through our actions, so that they are in a position to make appropriate decisions on matters that affect the health of our planet.

Climate change is expected to have direct and indirect impacts on earth. Scientists predict that we would lose nearly one third of our biodiversity, Sea levels would rise flooding low lying areas, face severe fresh water shortages , desertification , health issues such increased incidences of infectious diseases, heat strokes, forest fires, hurricanes and extreme and strange weather patterns to name some .

While governments are trying to fathom this new reality and looking at ways and means to tackle this global issue, it is becoming clearer to all, that only a concerted and collaborative action from each and everyone can actually help save this unique planet. United Arab Emirate too is aware of its responsibility and that is why despite being a country which is endowed with vast reserves of petroleum, a non renewable resource, and the one which contributes to climate change, it is working hard to establish the first carbon neutral city MASDAR in the coming few years and invest more on developing the renewable source of energy in the country. In addition, the country is also aiming to educate its future generation, through imbibing sound knowledge, imparting skill and helping to develop right attitude towards the environmental issues so as to prepare them to face any eventualities in the future.

We hope these books would be read by all students and would help them to understand the issue of climate change and the role that they can play in helping to save this unique planet.

CONTENTS

There's change in the air

The earth was never as warm as it is today. According to the Intergovernmental Panel on Climate Change, the years from around 1996 to 2007 were among the hottest since 1850. And the blame is on us.

Many creatures, many problems, one source

Global warming is causing the ice in the Arctic and Antarctic regions to melt faster than ever. If this continues, the tip of the Arctic, the earth's ice cap, will have no ice in summer by 2040! People like the Inuit are losing their livelihood. Even monuments like the Parthenon that have stood the test of time for hundreds of years, are now under threat from acid rain, caused by increasing greenhouse gases that human activities have unleashed into the atmosphere.

Just drowned

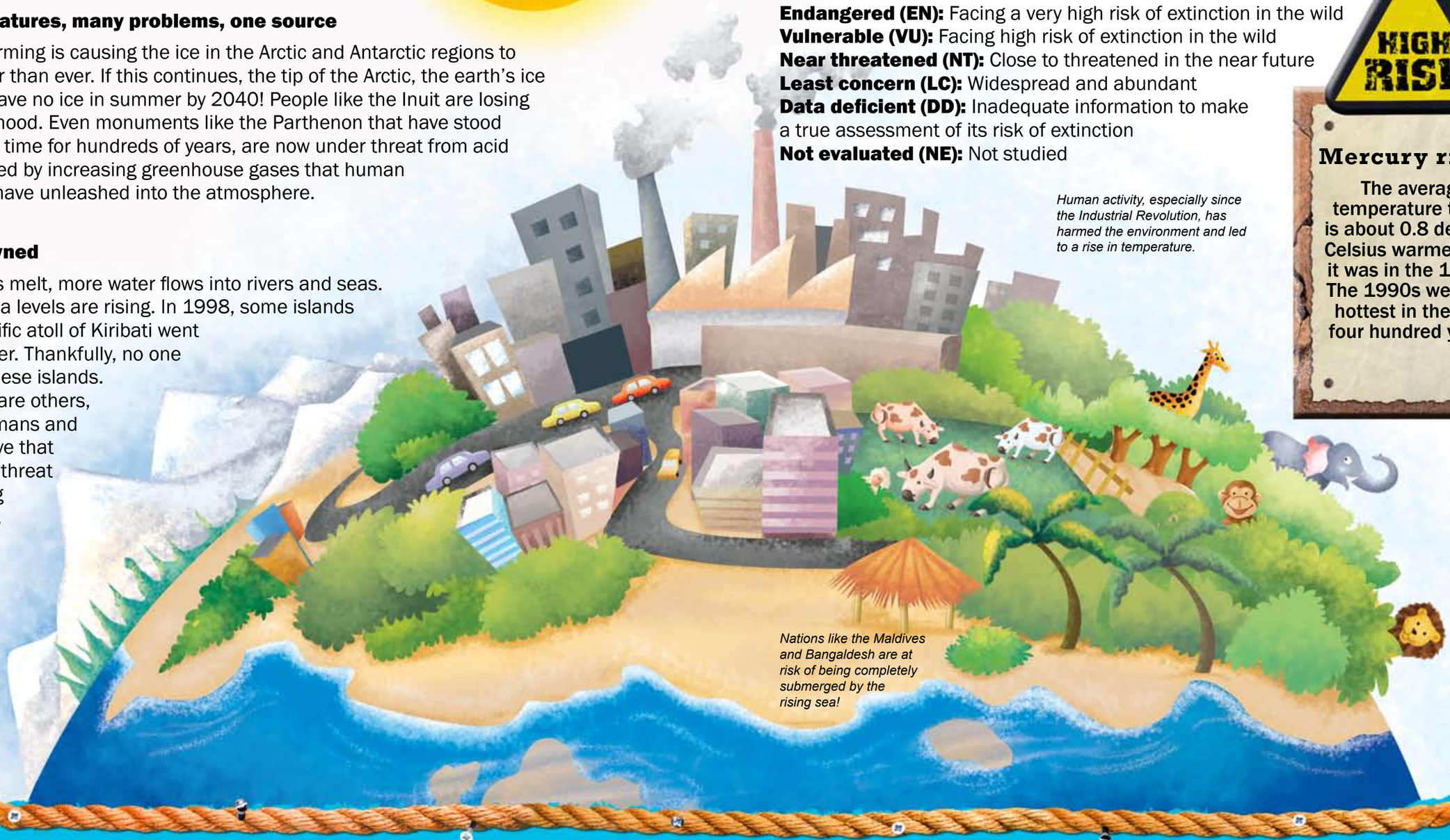
As glaciers melt, more water flows into rivers and seas. And so, sea levels are rising. In 1998, some islands in the Pacific atoll of Kiribati went under water. Thankfully, no one lived on these islands. But there are others, where humans and animals live that are under threat from rising sea levels.

Will we be on that list soon?

The World Conservation Union (IUCN, from its earlier name International Union for the Conservation of Nature) was founded in 1948. It is the world's first global environmental organization. It regularly releases the Red List on the status of animals and plants. It places its findings under several categories like:

Extinct (EX): Found only in cultivation or in captivity
Critically endangered (CR): Facing extremely high risk of extinction in the wild
Endangered (EN): Facing a very high risk of extinction in the wild
Vulnerable (VU): Facing high risk of extinction in the wild
Near threatened (NT): Close to threatened in the near future
Least concern (LC): Widespread and abundant
Data deficient (DD): Inadequate information to make a true assessment of its risk of extinction
Not evaluated (NE): Not studied

Human activity, especially since the Industrial Revolution, has harmed the environment and led to a rise in temperature.



Nations like the Maldives and Bangaldesh are at risk of being completely submerged by the rising sea!

Mercury rising

The average temperature today is about 0.8 degrees Celsius warmer than it was in the 1880s. The 1990s were the hottest in the past four hundred years!

Polar bear: melting homeland

The vast icy expanses of the Artic on the North Pole are home to the world's largest carnivore, or meat-eating animal, on land – the polar bear. Apart from the Artic, the polar bear is found in the US (in Alaska), Canada, Russia, Greenland, and Norway.

On an average a Polar bear requires about 2 kgs of fat per day to survive. A ringed seal provides up to eight days of energy for a polar bear.

Yo! That's me!

The polar bear is the largest member of the bear family. It is 8–10 feet tall. An adult male weighs 400–600 kg, almost twice as much as the female. This bear's body is well suited to its icy habitat. The thick fur is oily and waterproof, which allows the bear to shake it dry after swimming. The polar bear has huge, paddle-like feet that help them walk on ice as well as in swimming.

Polar bears don't drink water. They get all the liquids that they need from the animals that they eat.

Seals are the polar bear's primary prey. Typically the polar bear only eats the fat and leaves the rest of the carcass for scavengers that include arctic foxes, ravens, and younger bears.

Quite at home!

Though polar bears are born on land, they spend most of their time in the sea, hunting for their favourite food—seals. Their sharp and jagged teeth help in breaking apart the meat of seals. But seals are mostly found under the ice-covered sea. How does the bear catch it? Actually, there are air holes in the ice, where seals come up to breathe. It is here that a polar bear sits patiently to

Not so white!

The polar bear's fur is not white. It is actually hollow and reflects light. It also traps the sun's heat and keeps the bear warm.

Will global warming spare the polar bear?

The polar bear has roamed the icy Arctic region for ages, but the mighty creature is in danger now. In 2006, the IUCN added the polar bear to its 'Red List' of the world's most endangered animals. According to the IUCN, there are only 20,000–25,000 polar bears in the world. The greatest threat comes from global warming, which is melting the Arctic sea ice, where polar bears hunt seals, their primary food source.

Penguins: Will the happy feet march into extinction?

They are birds that can no longer fly. With wings morphed into flippers, they swim under water at high speeds, and waddle on land. They live in the coldest regions of the earth—mostly in Antarctica, but also in South America, Southern Africa, and the Australian island state of Tasmania.

Melting of ice caps due to rising temperature in the Antarctic Peninsula removes the sea ice that once held back the movement of the glaciers. As a result, glaciers are flowing into the ocean, six times faster than before, making sea levels rise!

The long and short of penguins

There are about 20 different species of penguins—the largest is the Emperor Penguin, which is about 3 feet 7 inches tall and weighg 35 kgs or more. The smallest penguin species is the Little Blue Penguin, which stands at around 16 inches and weighs 1 kg.

Warmth of my friends

Penguins are a lot like us, not just in walking on two legs. They use a sign language by waving their flippers and moving their heads to 'talk' to other penguins in the group. The father penguins are generally responsible for keeping the eggs warm before they hatch. When it gets very cold, all the dads huddle together to keep themselves and their eggs warm.

Penguins constantly face threat from other predators and living on ice is dangerous at times. As a result many penguin species don't go back to the ice or dry land to sleep. They take little naps in the water instead !

Emperor Penguins rely only on vocal calls for individual recognition between parents, offspring, and mates.

Not so happy after all

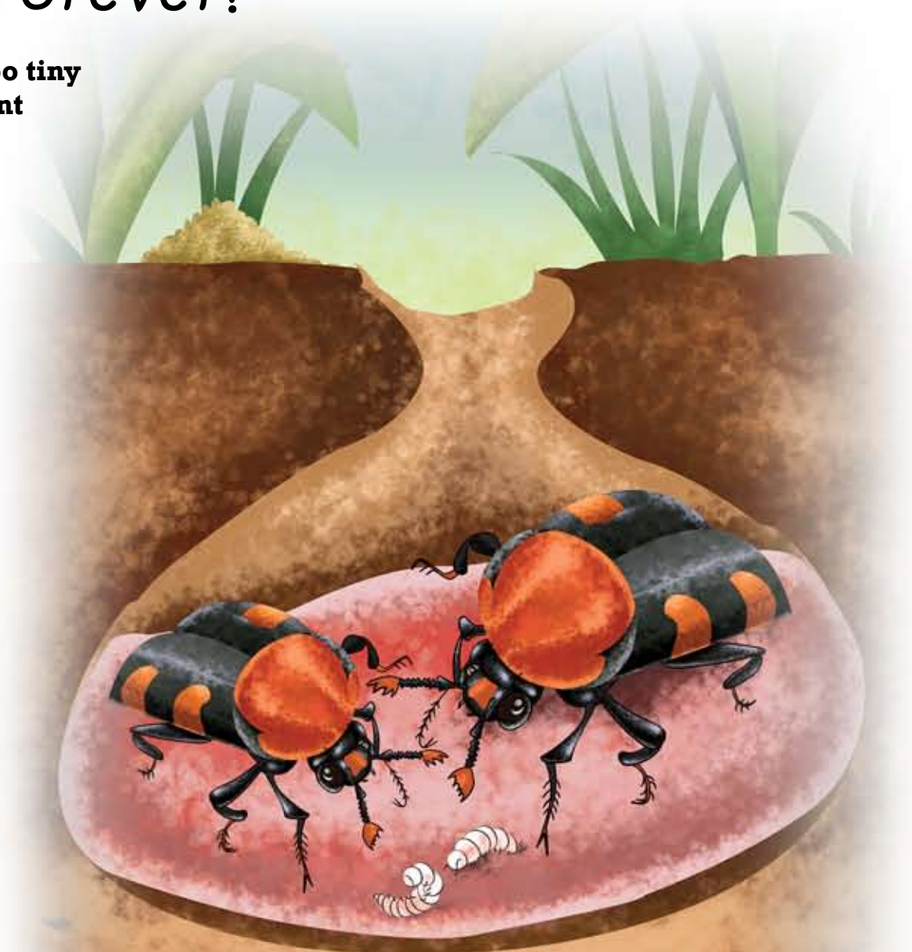
The march of the penguins may be halted after all, as 12 penguin species are considered 'at risk' or endangered. They are mostly threatened by global warming, habitat destruction, oil spills, and pollution of the seas. Global warming is not only causing the Antarctic ice to melt but warmer ocean temperatures are causing a decline in krill–the penguins' main food.

Heady feeling

Did you know that penguins don't drink water, but eat snow. They swallow ocean water when they catch fish. A special gland in their nose takes the salt out of the ocean water.

American burying beetle: buried forever?

No creature is too tiny to be unimportant to the health of our planet. Not very long ago, the American burying beetle could be seen across North America, from east of the Rocky Mountains right up to south Canada. Today, scientists are worried about its uncertain future.



No beetle other than the American burying beetle cares for its young.

Smart coat, that!

The American burying beetle is just about three centimetres long. It is the largest scavenger beetle in North America. It has a shiny black coat with two pairs of bright orange stripes that go across like bootstraps over the wing cover and stop just short of the spine. Unlike any other beetle, its pronotum, the area just behind the head, also has a blob of bright orange. The face has another orange blob between the eyes.

For the kids!

This beetle's life cycle depends on carrion, or dead flesh. A nocturnal creature, it works in pairs to look for food. The couple digs a hole under the carrion and covers the find with soil. Then, they chew a hole in the meat to lay eggs in. The caring parents feed their larvae regurgitated food and keep other insects away.

Changes in the beetles' habitat has pitched it against other carrion creatures, such as opossums, for food.

Be careful not to trample on the beetle when you are on a trek.

Losing ground

The beetle is not picky about its home, equally comfortable in forests as on the treeless prairie. By the 1920s, the American burying beetle was losing the number game. By 1989, it crawled its way on to the IUCN's critically endangered list. Entomologists guess there are just a couple of thousand of these beetles left around Oklahoma and on Block Island. It is a victim of habitat fragmentation. The home of the American burying beetle has been damaged by human activity. Agriculture, humans trampling through the wilderness on a trek, pollution, and mining upset it further. Like other insects, this beetle is drawn towards bright electric lights and gets singed.

Can this beetle be bailed out?

The Roger Williams Park Zoo is breeding these beetles. The American Fish and Wildlife Service and the zoo started sending them to Nantucket Island to breed undisturbed. A laboratory colony at Boston University breeds these beetles and reintroduces them in the wild.

Doting parents

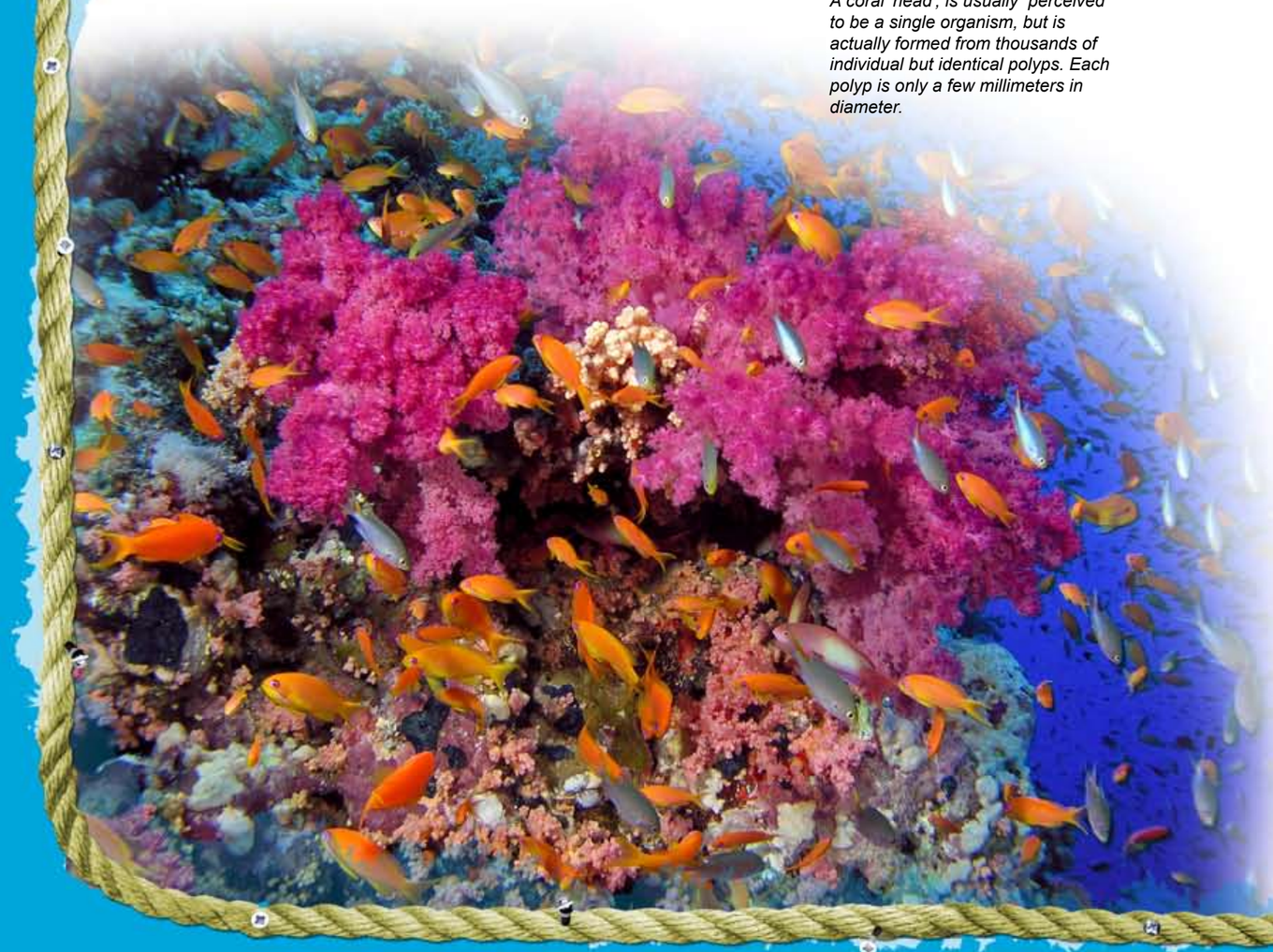
American burying beetles coat the host carcass with anti-bacterial saliva so that it does not get infected. If the carrion is too small to feed the brood, the couple kills some larvae to feed the others!

Corals: paradise lost?

Have you seen beautiful 'gardens' under the sea and wondered if these are made up of colourful rocks or plants? These are actually tiny, delicate animals called coral polyps, which live in colonies. These creatures build large and intricate structures called reefs, which accumulate from the slow growth of corals.

The little polyp

Corals are spineless animals and are close relatives of anemones and jellyfish. A coral polyp may be tiny as a pinhead or larger—about a foot in diameter. The polyp builds a hard, cup-shaped skeleton using calcium carbonate from sea water. This skeleton protects the polyp's soft, delicate body.



A coral 'head', is usually perceived to be a single organism, but is actually formed from thousands of individual but identical polyps. Each polyp is only a few millimeters in diameter.

Rome wasn't built in a day!

Some corals reefs that we see today began growing as early as 50 million years ago. Most established coral reefs are 5,000–10,000 years old.

10 per cent of the world's coral reefs are degraded beyond recovery.

Can't do without you!

The most important source of food for the polyps are single-celled algae called zooxanthellae, which live within the coral polyps. They use sunlight to make food, providing nutrition to the coral. The coral polyps provide the algae with carbon dioxide and a safe home. Coral polyps, which are generally white, also get their colour from these algae.

At home in warm waters

Coral reefs are found along the coasts of Polynesia, Africa, India, UAE, Qatar, north-west Australia, Florida (USA), to the Caribbean, and down to Brazil. There are also coral reefs in the Red Sea. The Great Barrier Reef, off the coast of north-eastern Australia, is the largest coral reef in the world. It is over 2000 km long.

The delicate balance

Corals are fragile and extremely sensitive to changes in the environment, including the presence of chemicals or change in temperature. Many coral reefs around the world are dying due to global warming, pollution of the seas, and damage by humans. Scientists have predicted that by the year 2030, more than half the world's coral reefs in the world may be destroyed. Many governments have enacted laws to protect the reefs.

Right whale: wronged for being right

The right whale would not be happy to know how it got its name. It has more blubber than most whales, which makes it move very slowly, and float when it is dead. So whalers thought it was just the right whale to hunt!

Hey, that's huge!

The right whale has about 270 pairs of baleen plates in its mouth, which filter food from water. Right whales can be about eighteen metres long and weigh about a hundred thousand kilograms! Forty per cent of its weight is fat, which slows it down to barely nine kilometres per hour. You would know the right whale because it has light callosities, or skin patches, on the dark skin around the two blowholes, the small eyes, and the chin. The blowholes are far apart, so the 'blow' is V-shaped. The right whale has flippers instead of dorsal fins.

Right whales eat as they go along, mouth open to let prey in!

Not the right thing to do

The right whale is an easy target because it often swims near the shore.

The right whale is hunted by just two creatures: the orca, or killer whale, and humans. Humans kill it for blubber and meat. Till about a century ago, whalers went out in wooden boats and used harpoons. Then came bigger, stronger mechanized boats. By 1750, the North Atlantic right whale was almost extinct. By 1937, there were so few right whales left that governments got together for a total ban on right whale killing. But illegal whaling continued for decades.

Whaling has reduced the right whale to the status of an endangered species. In the northern hemisphere, less than a thousand remain. The southern hemisphere has about three thousand to four thousand right whales.

Save Moby!

The slow right whale often dies after colliding with ships. In 2006, the National Oceanic and Atmospheric Administration of America floated the Strategy to Reduce Ship Strikes to North Atlantic Right Whales to force ships to slow down in areas where this whale lives. The International Whaling Commission (IWC) has also recognized climate change as a major threat to the species. Climate change will impact sea surface temperature, salinity and ocean circulation. All of this will alter food availability, migration routes, and reproductive rates of the whales.

Orcas are the only creatures other than human beings that can hunt down a right whale.

Right whales are carnivores and eat crustaceans like krill and copepods.

'Lice'nce to roost

The callosities on the right whale are not white skin but nests of whale lice, or cyamids!

Marco Polo sheep: a faint bleat

When intrepid explorer Marco Polo took the Silk Route to visit Kublai Khan around 1272, he wrote about an impressive wild sheep. The *Ovis ammon polii*, or Tien Shan argali, is called Marco Polo sheep.

Handsome hunk!

The Marco Polo sheep is the most majestic sheep in the world. It could have been like any of its cousins had it not been for its impressive, curving long horns. It is a large sheep, with long legs, and wears a thick dark winter coat. In summer, its fleece turns a speckled brown on the body, while the face, rump, legs, and chest are white. The horns curve out in an arch.

High in the mountains

The Marco Polo sheep is found deep inside Central Asia, in the Pamir Mountains that touch Afghanistan, China, Pakistan, Tajikistan, and south of the Naryn river in Kyrgyzstan. It is quite at home at altitudes of 3,000 metres to 5,500 metres. It feeds on the grass, herbs, and the longer rushes, or sedge.

The world record for the longest sheep horns rests with the Marco Polo sheep—about 190 centimetres!

The Pamir Mountains are home to the Marco Polo sheep.

Goodness has no borders

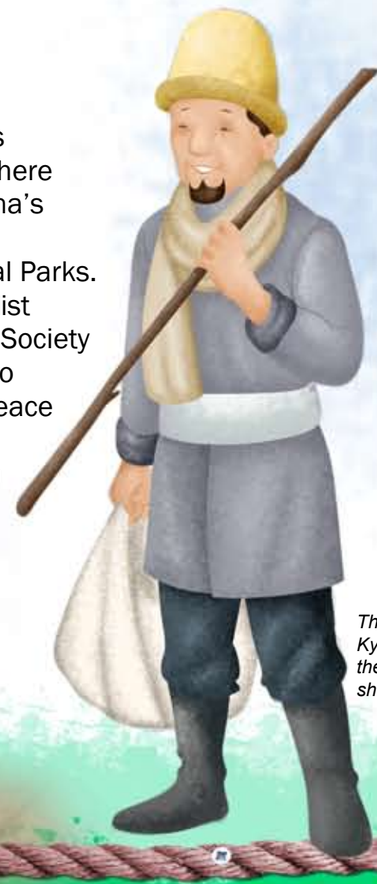
Dr George Schaller, born in 1933, first surveyed the Marco Polo sheep in Pakistan in the 1970s. His work led to more than twenty reserved parks all over the world. He continues to follow these sheep in the Pamirs.

Poor sport

The magnificent horns of the Marco Polo sheep have been its greatest downfall. Hunters from all over the world consider its crown a trophy to vie for. Since the 1990s, several hundreds have been killed for sport. Today, barely six thousand remain. In the hunting season, tourist guides organize hunting safaris with promises of bravado like: 'Marco Polo sheep hunting is one of the toughest and most exciting sports you will ever experience' and 'they are considered to be the number one sheep trophy in the world'. Locals used the skulls to mark sacred shrines in the mountains.

One man unites many countries

Some of the countries that this sheep calls home have come up with national parks where it is protected. They can roam freely in China's Taxkongau Nature Reserve and Pakistan's Khunjerab and Central Karakoram National Parks. Inspired by the untiring work of the naturalist George Schaller, the Wildlife Conservation Society has launched the Greater Pamir Initiative to create a fifty thousand-square-kilometre Peace Park covering parts of Pakistan, China, Afghanistan, and Tajikistan where the flora and fauna will also be protected.



The Wakhi and Kyrgyz tribes kill the Marco Polo sheep for meat.

Nightcap oak: found just in time

In 1995, Australian botanists were thrilled to identify the nightcap oak. Their joy was short-lived. Soon after, they found that it is critically endangered.

The woody fruit of the nighcap oak is hard to spot on the tree until it turns a dull golden yellow when it ripens.

A toast to the nightcap

The nightcap oak is a rainforest tree. Its highest branches can grow about forty metres above the ground. Pale, white flowers show up as summer sets in, around October. After that green fruits, about four centimetres in diameter, appear. They take more than a year to ripen and are ready by the next December. By March, they turn pale brown and are shed.

Soil story

The nightcap oak is fussy about where it grows. It grows on yellow podzolic soils found in the rainforests of southern Australia. These forests get more than 2,500 millimetres of rain every year. In millions of years, the nightcap oak has not been able to spread further.

The leaves of the nighcap oak change from bright orange, when they are young and new, to dark green.

Old tree, new find

In the 1960s, botanist Bernie Hyland found two light brown fruits. It took him more than twenty years to identify the tree as nightcap oak.

The nightcap oak is not a new tree. Unfortunately, the tree that survived millions of years is on its way out. There are less than two hundred nightcap oaks left. More and more land is being cleared for forests, and trees are being cut for timber. Since this tree grows only in a small area, it may be wiped out soon.

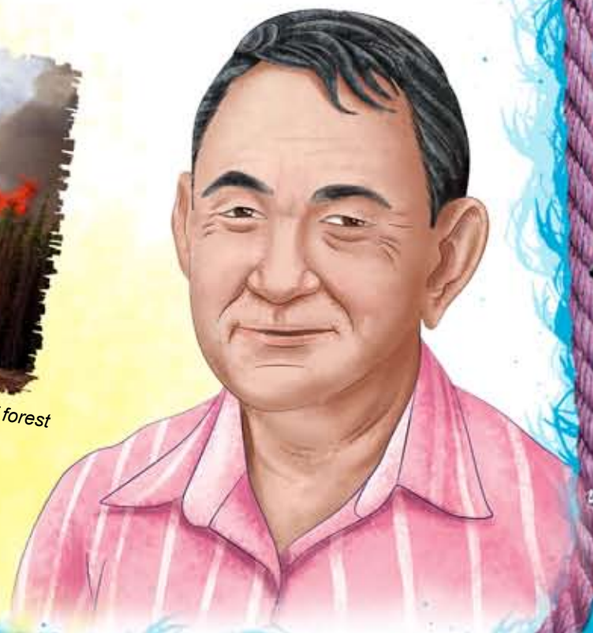
Old tale

The nightcap oak is one of the oldest flowering plants of Australia. Fossil fruits hint that the tree has been around for fifteen million years.

What is being done?

Some of these trees grow in forests under the protection of the Central Eastern Rainforest Reserves (Australia). The Department of Environment and Conservation of Australia is working to save this tree. It has in place a National Recovery Plan. Visitors, who often trample on seedlings by mistake, are being directed to stay within walking areas. They are also trying to prevent forest fires and stop felling of trees in areas where the oak grows.

Forest fires have burned down acres of forest where the nightcap oak grows.



Bernie Hyland

Heart-leaved plantain: vanishing weed

Mighty trees are in danger of becoming extinct. So are herbs that you would barely notice, like the heart-leaved plantain. But it is just as important to save these tiny plants from disappearing forever as it is to save big trees.

Mines, farms, towns and cities, and roads have replaced the marshlands where the herb grew.

Not quite bananas!

If you believed that the only plantains are bananas, here's news. Some, like the heart-leaved plantain, are low-growing weeds, or herbs, that have heart-shaped leaves up to thirty centimetres long. The winter leaves are smaller. The plant has small purplish summer flowers that are speared on top of the flowering stem, or spike, about fifteen centimetres long.

Hanging around

The heart-leaved plantain grows round the year in North America. It is semi-aquatic, happy to be around water. That includes places that are waterlogged or swamps. The heart-leaved plantain grows well in rocky areas, pushing its way up through a crack or in deciduous forests.

Death knell

Till some time ago, the heart-leaved plantain was found from Ohio to Minnesota, a wide range sweeping across North America. It can now be found in far smaller patches. One of the biggest culprits is habitat destruction. This means, land where the plant used to grow has been taken over for some other purpose. Rivers and streams along which it grew have been diverted for agriculture and other uses. New species introduced into the region have proved stronger than local plants.

Saving grace

The heart-leaved plantain is endangered. Canada is trying to save it, and bring it under the protection of the Ontario Endangered Species Act. This ensures that the weed cannot be collected. It also protects its habitat. In the Carolinian Woodlands of Canada, efforts of the Carolinian Woodlands Recovery Team of 2004 to save the woodlands may help the herb recover. The Canadian government will also not charge tax from those who keep at least two thousand square metres of their land for the natural species of the area.

As habitation spread, wetlands dried up and the plant died out.

The roots of the heart-leaved plantain are thick and long and have been used to make traditional medicine that can fight stomach ailments.

The heart-leaved plantain is particular about where it grows and the quality of water!

By design

Willie Tsang, a graphic designer, has a range of furniture called 'Save the Plants' to remind people about twenty-one flowers endangered in Canada. The heart-leaved plantain is one of them.

Magnolia: fading fragrance

Had French botanist Pierre Magnol (June 8, 1638–May 21, 1715) been living today, he would have been a sad man. The beautiful magnolia tree, named after him, is losing the battle for survival.

Before the bees

The magnolia is an ancient tree. Scientists have found fossils of the magnolia that are twenty million years old. That's before the bees came into existence! The flowers were pollinated by beetles then. The magnolia is a deciduous tree that grows up to a height of about seven metres. It sheds its dark green leaves in winter, and the white, pink or purple perfumed flowers arrive to welcome the new leaves. The flowers do not have true petals and sepals. The two are more or less combined in 'tepals'.

The world is the stage

In the wild, the magnolia is found in Southeast Asia, in the Americas, and the West Indies. Asia is home to two of every three magnolia trees in the world. Most of the magnolias found in North America and Europe were perhaps carried back from Asia for their beautiful flowers.

The magnolia is an old and tough plant that has survived for millions of years. When a tree that tough dies, it can only signal bad news for weaker species in the world.

Used the abused

Scientists know of 245 wild magnolia species. A 2006–7 count showed that 131, or more than half the species, are threatened. Seven of them are critically endangered.

In many places, the habitat of magnolias has been destroyed for plantations of fruits like banana that are necessary to feed a growing population.

Is anyone listening?

Several species of the magnolia have been cultivated from their wild parents. Now, there are plans to cultivate the ones that are most likely to die out. These will be grown in different parts of the world so that some specimens remain.

The tree has been cut down for its wood. The bark has been stripped for medicine. Without the bark, it is prone to disease.

Even cultivated magnolias in North America have faced problems. Many were damaged by Hurricane Katrina in 2005, and had to be cut down.

Common cure

Chemicals in magnolia can fight bacteria such as shigella, staphylococcus, and streptococcus. The extracts from the trees can be made into medicines for depression, common cold, blood pressure, upset stomach, and even cancer!

St Helena ebony: the struggle of two shrubs

A tiny South Atlantic Ocean island is fighting to save a tree that carries its name. St Helena, where Napoleon Bonaparte lived in exile from 1815 till his death in 1821, was known for the St Helena ebony. Just two of these trees remain in the wild.

The pride of an island

The St Helena ebony is quite sturdy. It can bear a certain amount of drought and so can survive in warmer, lower slopes. Its wood is hard and dark. Its heart-shaped leaves are dark green in colour and velvety on the underside. Each inflorescence, or flower stalk, holds about three creamy white flowers that give way to dull brown seeds. As they age, the flowers turn light pink.

If only!

The Portuguese discovered St Helena in 1502. They let goats free on the island. By the time Napoleon was sent to live there, the St Helena ebony was virtually trampled down and chewed up by grazing goats. Hundreds of statues and decorative items were made from its dark wood. It was also used as fuel in lime kilns. Soon, the tree could not be located on the island and was believed to be extinct.

In 1980, two St Helena ebony trees were rediscovered, growing on a rock face.

Last hope

Beginning 1980, botanists from various organizations, including Royal Botanical Gardens at Kew, London, began growing St Helena ebony from the cuttings and seeds of the two specimens discovered in the wild. Three gene banks try to make the new trees sturdy. But the plants are slow in growing. The weak roots get damaged when they are planted back. The new trees may also be weaker, since they come from the same stock.

Fighting for its survival, the St Helena ebony that used to be about five metres tall has now been reduced to a shrub!

St Helena ebony has strong survival instincts. The pollen-producing anthers open before the flower blooms so that pollen brushes the top edge of each petal. So any insect touching the flower helps in cross-pollination.

Wreath of remembrance

The flower of the St Helena ebony is included in the wreath made by the Royal Botanical Gardens, Kew. It is laid at the London Cenotaph on Remembrance Day so that we do not forget this endangered plant.

Machu Picchu: trampled by tourism

Machu Picchu, tucked into the Andes mountains of Peru, is an ancient city founded by the Incas. The city dates back to about AD 1460 to the time of Inca ruler Pachacuti Inca Yupanqui and his descendants. Machu Picchu means 'old peak'.

The ancient city of Machu Picchu is also called 'city in the clouds'.

A mountain retreat

The city had many stone structures. It had about two hundred buildings that included homes for over a thousand people, temples, and granaries. The houses were built of granite hewn out of the rocks. They fitted together like a perfect jigsaw puzzle that needed no mortar. Since they were cut by hand, no two blocks are identical. Some of them have thirty corners! People stopped living in Machu Picchu around the 1530s.

Curious armies

In 1911, archaeologist Professor Hiram Bingham stumbled upon Machu Picchu, a city that covered almost thirteen square kilometres. It was shrouded in clouds and was watered by mountain springs.

Ever since Professor Bingham found Machu Picchu, the number of tourists visiting the city has grown. At first, most visitors were students and archaeologists. Then, the hordes came. In 1992, about nine thousand tourists checked out Machu Picchu. In 2006, about four thousand people visited in a day! Machu Picchu has become Peru's largest grosser from tourism.

The Intihuatana is a uniquely preserved wide pillar and pedestal that were carved as a single unit and are 6 feet (1.8 metres) tall.

It is believed that Inca ruler Pachacuti Inca Yupanqui built Machu Picchu as his royal retreat.

Lost and found

The environment around Machu Picchu has been degraded to accommodate tourists. A new eighty-metre bridge connects Machu Picchu with Santa Teresa town, so that more tourists can visit it.

In the 1980s, a rock from the Central Plaza was removed so that helicopters could land at Machu Picchu. In September 2000, the Intihuatana, or holy sundial, was damaged. An industrial crane crashed on it while advertising agency JWT was shooting an advertisement.

Wake up!

Helicopters have been stopped from landing at Machu Picchu since 1990. There are plans to construct a tram line. This would just bring in more tourists. In 2000, the ancient town went on the World Monument Fund's Watch List and will be given help to restore it. Machu Picchu has been a UNESCO World Heritage site since 1983. But things are getting worrying, so UNESCO may put Machu Picchu on the list of Endangered World Heritage Sites.

The sun is going nowhere!

'Intihuatana' means 'post to tie the sun to'. At midday, on the equinoxes of March 21 and September 21, with the sun directly above, a priest tied the sun symbolically to the stone so that the sun could not disappear.

Parthenon: pockmarked by acid rain

The Parthenon of Athens is one of the world's most admired monuments. It has won the awe of visitors since 5 BC. Today, it is worrying archaeologists.

The rectangular building was constructed of brilliant white marble and surrounded by 46 great columns.

Herculean feat

Work on the Parthenon began in 447 BC. The legendary architects Kallikrates and Iktinos ensured that most of the work was done in fifteen years. Its main designer was the sculptor Phidias. The ornamentation took another year. It had forty-six outer pillars and nineteen pillars inside, which supported the roof of overlapping marble tiles. The marble had to be transported about sixteen kilometres from the city of Athens.

Up the highest hill

The Parthenon stands majestic over the Acropolis, the highest hill in Athens. In ancient times, the Acropolis was home to the kings. Later, when Athens changed its form of government and did away with monarchy for oligarchy, or the government of a few people, the Acropolis was dedicated to Athena. The current Parthenon stands where an earlier Parthenon was destroyed by raiding Persians around 480 BC.

The Parthenon was a temple raised to the goddess Athena.

The exterior of the Parthenon is beginning to crack because of pollution and acid rain.

Down the centuries

In 296 BC, the statue inside the Parthenon was stripped of the gold by a general, Lachares. It was used as a church in AD 5 and as a mosque in 1460. Some sculptures were torn down when the church was built. In recent years, poisonous fumes from industries and automobile exhaust have damaged the marble. They have also led to acid rain, which is eating away the stone structure. The marble frieze panels have been transformed by acid rain into gypsum. Loosing much of its details, the exterior of the Parthenon is also beginning to crack and flake off.

The Parthenon housed a nearly 40 foot tall statue of the goddess Athena. The statue, was made of wood, gold and ivory and could be seen from a distance of many miles.

One bright idea

Several organizations like the British Committee for the Restitution of the Parthenon Marbles are trying to save the Parthenon. The marble statues that remain at the Parthenon are being destroyed by acid rain. The authorities will move seven statues to a museum. They will be replaced with replicas. But the main structure cannot be replaced. It continues to be eaten away by acid rain.

Monumental loss

The marble frieze panels on the Parthenon have been transformed by the acid rain into gypsum, which is soluble in water. So the Parthenon may slowly wash away or flake off.

Friday Mosque, Chinguetti: the desert catches up

Chinguetti is an oasis city in Mauritania, in north-west Africa. The Friday Mosque of Chinguetti has stood like a rock for the faithful since the thirteenth century. Now, the desert is creeping up on it.

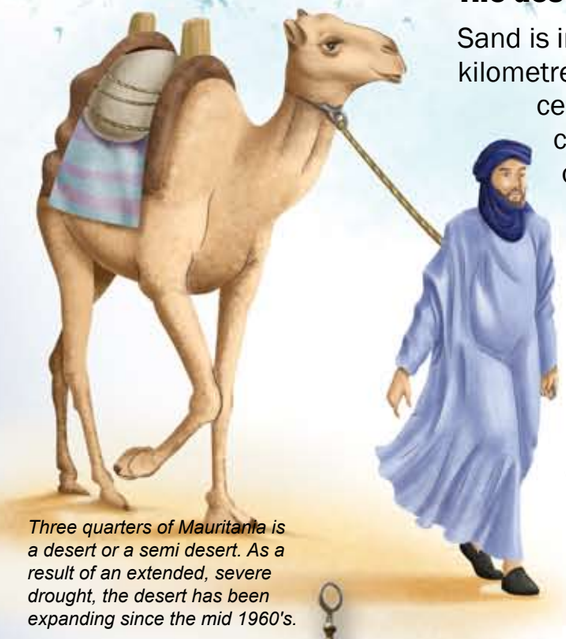
Emblem of a nation

The Friday Mosque is a simple structure. It is made of stone and the minaret is a square tower. It has a prayer room and a mihrab, or arch facing the holy city of Mecca. The floor has a layer of sand. The room has four aisles and an open courtyard.

At home in an ancient city

Chinguetti was founded in AD 777. It almost came to an end after a few centuries. Then, it was revived in the thirteenth century. The city and the mosque probably go back to the same time. Chinguetti was an important trade centre. There are many old buildings in the city like the French fort and the water tower. Five libraries preserve holy manuscripts of the Quran.

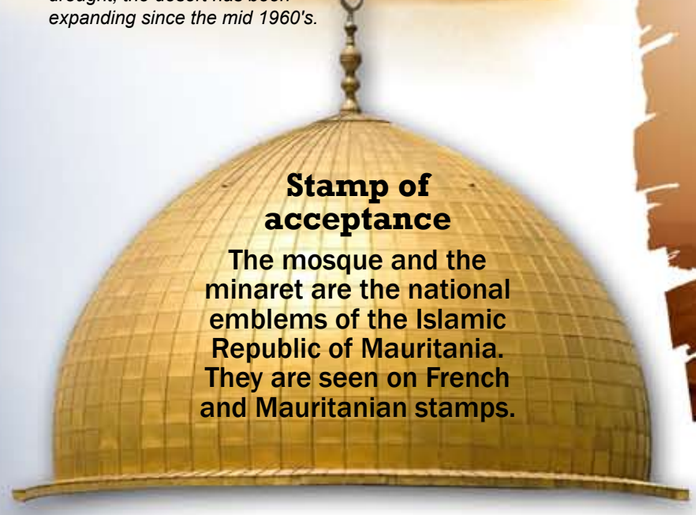
The minaret is crowned with five finials—clay sculptures of ostrich eggs.



Three quarters of Mauritania is a desert or a semi desert. As a result of an extended, severe drought, the desert has been expanding since the mid 1960's.

The desert creeps up

Sand is inching up to Mauritania by five to ten kilometres every year. Mauritania now gets 20 per cent less rain than it did in the 1950s. One cause of this is the rise in temperature over the land and over the nearby Atlantic Ocean. Lack of moisture makes the sand fly further and faster. People have chopped down trees to feed camels and goats and for firewood. The roots that held the sand in place are gone. The trees that are still alive are biding time. Heaps of sand are building up around date palm trees. Soon, the trees will be smothered.



Stamp of acceptance

The mosque and the minaret are the national emblems of the Islamic Republic of Mauritania. They are seen on French and Mauritanian stamps.

Chinguetti was once a green city where ostrich lived! Today, doors of houses get blocked overnight by sandstorms.

Don't cut that tree!

New laws have made it illegal to cut most of the trees and plants in the region. But unofficially, the alfalfa plant that is laid out to cool the roof is still cut. In the 1970s, UNESCO stepped in to restore the mosque. The city has been declared one of UNESCO's world heritage sites. The National Foundation for the Safeguard of Ancient Towns in Mauritania plans to look after the mosque.

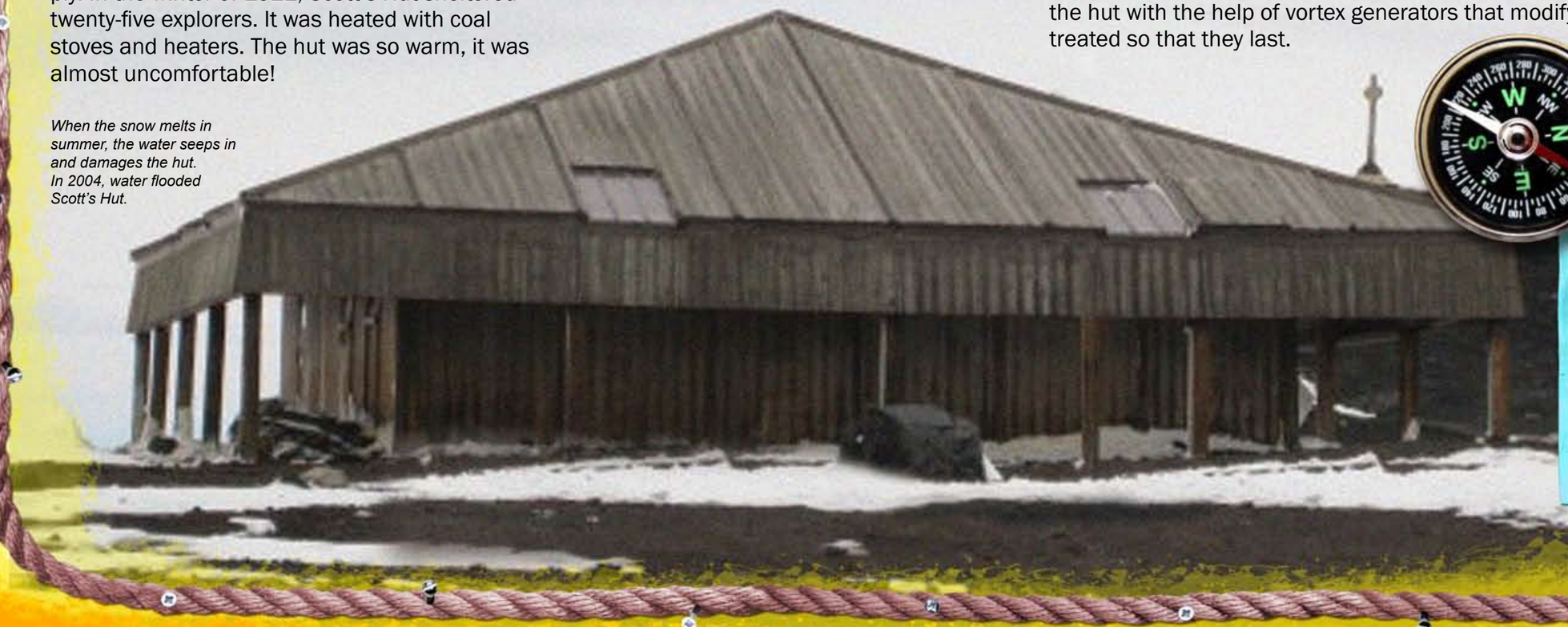
Scott's Hut: who'll shovel it for safekeeping?

British explorer Robert Scott was the second human to reach the South Pole. He was among the pioneers who dared to discover Antarctica, the frozen continent. Today, climate change threatens to swallow up his cabin, Scott's Hut.

Robert Scott

One feisty cabin

Scott's Hut is at Cape Evans on Ross Island in Antarctica. Scott's Terra Nova expedition started in 1910, but the cabin came up the next year. It was insulated with seaweed sewn into a covering. This quilt padded the space between two layers of plank walls. The roof, also padded with seaweed, had three layers of planks and two layers of rubber ply. In the winter of 1911, Scott's Hut sheltered twenty-five explorers. It was heated with coal stoves and heaters. The hut was so warm, it was almost uncomfortable!



When the snow melts in summer, the water seeps in and damages the hut. In 2004, water flooded Scott's Hut.

Global warming on a melting continent

Antarctica is warming up because of climate change. Satellite imagery from the National Snow and Ice Data Center shows that an ice shelf spread over 13,680 square kilometres has started collapsing due to sudden climate change.

Scott's Hut at Cape Evans is in danger. Blizzards are blowing in more snow than ever before. About hundred thousand kilograms of snow collects around and on the hut in a few months. Scott's Hut may collapse from the weight.

Supplies from Scott's expedition are still kept at the camp, just as they were when he left.

Can anyone turn back the climate clock?

Scott's cabin still has the scientific equipment that he left behind. These are part of our Polar heritage. Scientists and volunteers spend several days every summer looking after Scott's Hut and other such historical buildings. They clear snow from around the house. The Antarctic Heritage Trust is working to preserve the structure in several ways. One of the first things that it intends to do is to keep snow from blowing in on the hut with the help of vortex generators that modify the flow of air. Artifacts will be treated so that they last.

Race to the finish

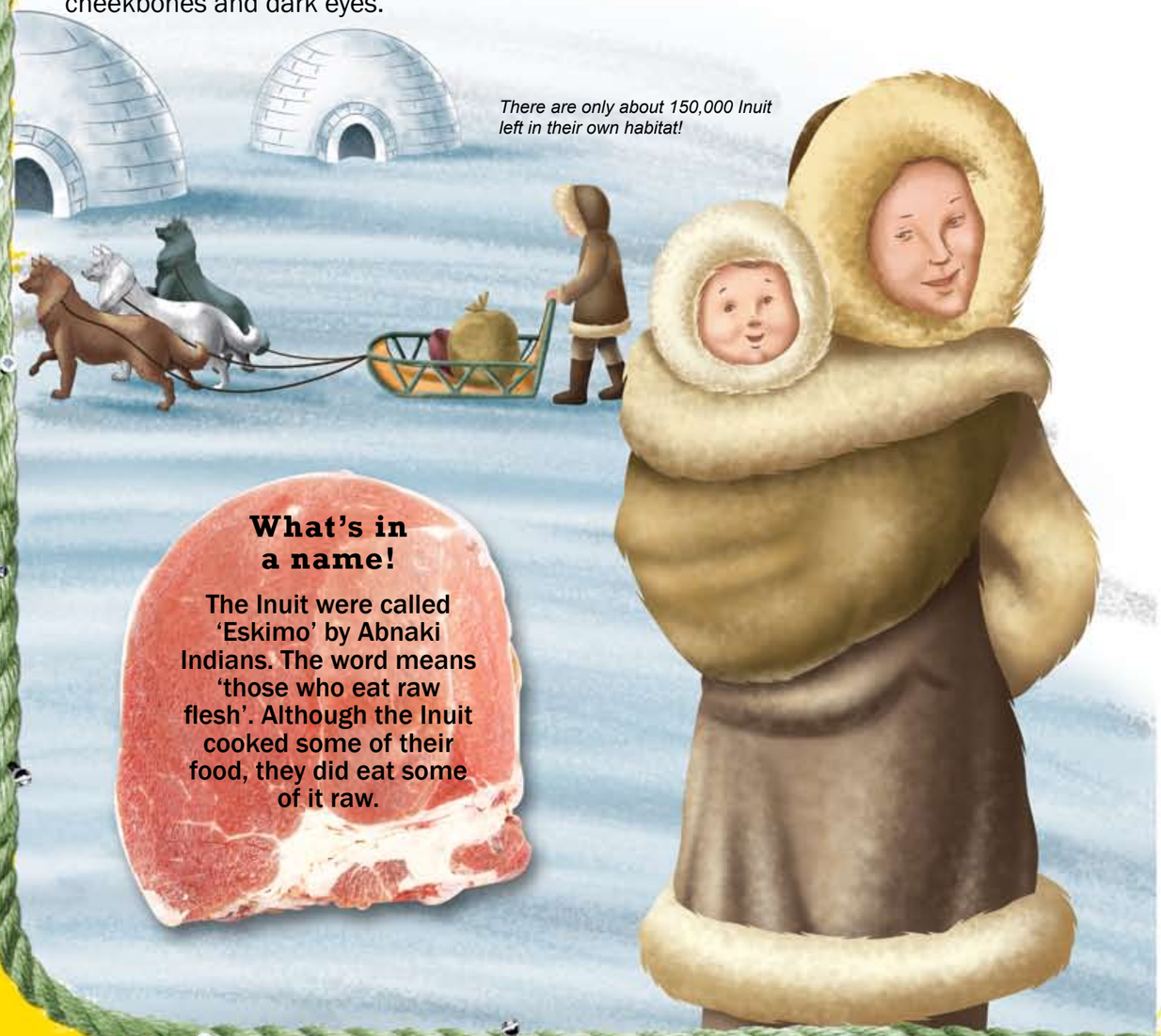
Scott left the cabin on November 1, 1911, trying to beat Norwegian explorer Roald Amundsen to the South Pole. Scott did reach, but after Amundsen. Scott and his exhausted team died in March 1912 of the intense cold on their way back from the Pole.

Inuit: lifestyle melting away

The Inuit people live in the Arctic and sub-Arctic region. Their land falls within Canada, Greenland, and Alaska (in the US).

Strong people

The Inuit are stocky, strong people. Most of them are about 1.5 metres in height. For centuries, they have been living in one of the coldest regions of the world, and so, their circulatory and digestive systems have adapted to the climate. They have light brown skin and thick, straight black hair. Their faces are wide, and they have high cheekbones and dark eyes.



There are only about 150,000 Inuit left in their own habitat!

What's in a name!

The Inuit were called 'Eskimo' by Abnaki Indians. The word means 'those who eat raw flesh'. Although the Inuit cooked some of their food, they did eat some of it raw.

People of harsh land

The Inuit were spread over about 5,150 kilometres of the Arctic. They hunted seals, whales, and fish. In winter, they hunted the polar bears, caribou, foxes, and hares. Since these animals move with the seasons, the Inuit followed them. In summer, they lived in tents made from the skin of animals they killed. In winter, some of them built houses of snow, others made houses of chunks of grass and soil, or sod.

The Inuit erected inukshuks in the image of man. Today, most of their customs are lost.

Enter, a new world

Centuries ago, Europeans started entering Inuit land. Gradually, they changed the way the Inuit lived. They brought in diseases. As trade increased, more Inuit land was occupied. Some Inuit, who shifted to the new towns and settlements, live in crowded homes.

Global warming has made summers longer and winters shorter. With ice melting faster, sea levels are rising and may flood Inuit habitat. Permafrost, the permanently frozen layer that lies just beneath the topsoil, in the Arctic is thawing. This is releasing more methane gas, which adds to global warming.

Is the world listening?

In the next century, the Arctic will get warmer by four to seven degrees Celsius, double the warming elsewhere. In 2005, the Inuit Circumpolar Conference complained against the US for releasing the largest amount of greenhouse gases. "We refuse to disappear. We will not become a footnote to globalization," they declared, asking the US to reduce the emission of greenhouse gases.

Global warming is depleting the number of Arctic animals, making hunting more difficult for the Inuit.

Penan: the price of 'prosperity'

The Penan is the only nomadic tribe in Sarawak on the island of Borneo, Malaysia, and in Brunei. Although there are about ten thousand Penan in Malaysia, only two hundred of them continue to live as nomads.

A different tribe

The Penan are a gentle, polite people. Their skin is lighter in colour than that of other tribes of the region. Their eyes are narrow and the cheekbones high. Their hair is thick and black. They believe everyone is equal, and they share whatever they have among themselves.

The Penan believe in 'molong'—the practice of using forests and natural resources in a manner that they are preserved for future generations.

Happy in the rainforest

These nomadic hunter-gatherers eat a lot of sago. They eat anything they can catch, even squirrels. Barking deer though, is a favourite. Actively defending their forests and their way of life, indigenous people are our best line of defense against the destruction of forests. In order to combat global warming, reforestation and prevention of logging is a must. The survival of the Penan's, our planet and the entire human race rests largely on the preservation of trees.

Shooed out

The Penan were safe in their forests till the 1970s. That is when the demand for timber went up and forests were cut down. Dams were built and forests were converted into palm plantations. When they protested, their complaints were mostly ignored. Most of them were forced to settle in towns.

New to urban life, they live in poverty and ill health. The timber merchants often threaten to kill them. The rich and powerful timber companies also offer the Penan jobs and money to win them over.

The Penan hunt with poisoned blowpipes.

Fighting back

The Penan have been protesting this invasion since 1978. These peaceful people block the roads the timber loggers take. Some companies backed out but not all listened. The Penan still need to be given the right to own the land they live on. They have hunting rights inside Mulu and Pulong Tau National Parks.

Penan leaders like Kelesau Naan filed a case for land rights. Seventy-three-year-old Naan was found dead in January 2008. His people believe he was murdered.

Saying without words

Penan use a sign language in the forest. Twigs and folded leaves are placed with messages like, 'Follow me'!

Yanomami: grappling with the Garimpeiro

Excellent hunters, the Yanomami look for monkeys, wild boar, fowl, and snakes.

The Yanomami are a large original tribe of South America. They live in the Amazon rainforests, along the border of Venezuela and Brazil. It has only been a hundred years since they interacted with the outside world, but they are already losing their way of life.

A strong tribe

The Yanomami are intelligent and cheerful. Like most tribes, they are muscular. They are a healthy tribe that has developed immunity to most of the illnesses of the area. They are short and well-built. They have broad shoulders. Their brown skin has a yellow tint and the hair is thick and black. They have little body or facial hair. They have high cheekbones and thick lips. The eyes are slanted and rather narrow.

Happy people

The Yanomami live so deep inside the jungle that outsiders have to trek hundreds of kilometres through forests to reach them. There is plenty of food in the rainforests, and the Yanomami eat fruits, honey, and eggs. They eat fish and the larvae of bees. Tribes like the Yanomami live in complete harmony with nature. This tribe understood the ecological importance of the rainforests where they have lived for generations. As a tribe they realized the ecological importance of the rainforests and the damaging effect their destruction could have over world environment.

At the hands of marauders

In the 1970s, gold and precious stone diggers, called Garimpeiro, began raiding Yanomami land. In 1990, over forty thousand raiders killed Yanomami to take over their land. The raiders also brought diseases. Twenty per cent of them died in seven years. Loggers who are a real threat to these people and environment at large are increasingly trespassing on indigenous lands in search of mahogany trees.

A good Yanomami cook knows how to grill, boil, and roast food. Tapir is one of their common food.

Help, finally

Brazil does not allow tribal groups to own land. In 1992, after groups like Survival International and Commission for the Creation of a Yanomami Park fought for the rights of Yanomami for twenty years, Brazil opened the Yanomami Park over about hundred thousand square kilometres. Most miners were made to leave. Though modern medical staff have been brought in, traditional medicine is encouraged.

The Yanomami are hunters and gatherers. They also fish and grow crops.

Room for plenty

A Yanomami village, of up to four hundred people, lives under one roof! The shabono is an oval shelter around a huge courtyard. Each family lights its own fire to cook.

Bushmen: the hunter is hunted

The Bushmen have lived in the Kalahari desert of Africa for about twenty thousand years. Some scientists believe that they were the first people on the earth. As they form closer ties with the western civilization, and as their lands get earmarked for reserved forests for wild animals, these hunter-gatherers are in trouble.

Bushmen cave paintings depict scenes from daily life, including hunting.

In 1997, the Botswana government ordered these hunter-gatherers to leave the Central Kalahari Game Reserve.

Now, that's a Bushman!

The word 'Bushmen' is used for a group that includes several others. They are also called San, Basarwa, and Khwe. Bushmen are active in their natural surroundings. This makes them lean and athletic. They can run long distances chasing animals. Bushmen have high cheekbones and lighter skin than many other ethnic groups in Africa. They have thick, dark, curly hair.

Children of the forest

The Bushmen eat seeds, nuts, roots, and entire plants. They are also excellent hunters and use poison-tipped spears and arrows. Their home spans Angola, South Africa, Namibia, and Botswana. They are simple people who live in make-shift wood homes. Even women go out to collect food.

Your home no more

The Bushmen lived the same life for thousands of years. Then, the Europeans entered Africa. They wanted to 'civilize' the Bushmen so that they followed western culture and religion. Governments, like that of Namibia, gave permits to kill Bushmen. The land that the Bushmen used to hunt on is being fenced in and used for farming and grazing cattle. During the 1950s the Bushmen had to convert to farming and grazing cattle. Climate change and use of genetically modified seeds created an enormous effect on their lifestyle.

What's that you said

Bushmen have a unique language that includes clicking sounds. These are written as '!' or '/'. One group that lives in Angola, Botswana, and Namibia is the !Kung.

Today, less than a hundred thousand of the millions of Bushmen remain.

By 2005, the quiver tree, used by the Bushmen to make quivers, was dying. New trees of this species are growing away from the equator. This is called the pole-ward range shift.

Less rain means less or no food. The Bushmen are having trouble being able to produce enough food for survival.

Quiver Plight

The famed desert tree used for generations by Africa's bushmen to make quivers for their arrows is threatened by global warming. The quiver tree has iconic status in Namibia, where its blue-green crown stands out against a parched landscape.

Glossary

Abdominal gout— gout is a painful condition that usually affects joints. In rare cases, it can attack other parts of the body like the abdomen

Acid rain— rainfall that becomes acidic due to environmental pollution. Acidity is measured on the pH scale of 0 (most acidic) to 14 (most alkaline). Rain has a natural pH balance of between 5 and 6. Anything less than that is acid rain.

Anti-bacterial— something that destroys bacteria

Archaeologist— one who studies history through excavating, or digging out, historical sites and findings like pottery

Baleen plates— two rows of flat whalebone plates in the upper jaw of a whale that has no teeth. Baleen plates filter the food that the whale swallows with water. It presses the tongue against the jaw, spitting out the water and keeping only the food.

Bile— bitter liquid produced by the liver to digest food

Blowhole— hole for blowing or breathing, located on the top of the head of a whale or dolphin

Blizzard— violent snow storm

Blubber— fat, especially of sea mammals

Captive breeding programme— to plan and breed species that are rare or endangered in zoos or special places

Carrion— decaying flesh of dead animals

Cross-pollination— pollen of one flower transferred to another

Desertification— the transformation of land that was not a desert into arid land because of human activity and climate change

Dorsal— of the back

Entomologist— scientist who studies the life cycle and behaviour of insects

Global warming— literally, the heating up of the earth's atmosphere. Now, it refers to the unusually warm temperature caused by burning fossil fuels and the release of greenhouse gases

Greenhouse gas or GHG— gas such as methane and nitrous oxide, which contribute to the greenhouse effect. These gases trap the heat of the sun instead of letting it escape into the atmosphere. This heat envelops the earth, heating it up like a greenhouse. This is the greenhouse effect. A certain amount of greenhouse gases occurs naturally. Without them, the earth would be too cold to live on.

Habitat fragmentation— changes in the natural home of a plant or an animal. It can be caused by natural changes or human activity and can lead to the extinction of species.

Industrial Revolution: — a noticeable change in the eighteenth century with more machines taking over mechanical work. These machines generally work on fossil fuels that release greenhouse gases when they are burned for energy.

Methane— greenhouse gas released by cattle after digesting food, and from burning fossil fuel

Minaret— tall tower of mosque

Nitrous oxide— a greenhouse gas that is released through burning fossil fuels and biomass and from agriculture

Nocturnal— active or occurring during night

Quiver— case for holding arrows

Regurgitate— bring swallowed food that has not been digested to the mouth

Replica— copy

Sago— a starchy food made from the inside of the sago palm

Scavenger— animal that feeds on dead animals and waste

Sepal— usually green, sepals lie just below the petals

Index